Woolen and Worsted Fabrics Glossary

Containing instructions for the manufacture of every known grade and variety of Woolen and Worsted Fabrics. *PRICE $3.00*

FRANK P. BENNETT & CO., Inc.

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Woolen and Worsted Glossary

CONTAINING INSTRUCTIONS FOR THE MANUFACTURE OF EVERY KNOWN GRADE AND VARIETY OF WOOLEN AND WORSTED FABRICS.

Textile Fibres

Students of the woolen and worsted industries who desire to obtain a fairly comprehensive knowledge of the subject must not only learn the various processes of manufacture by means of which the numerous varieties and grades of stock are transformed into finished fabrics, but should also inform themselves as to the animals from which the wool and hair are derived. The nature and structure of the various fibres, the countries and climates inhabited by different types of sheep and other producers of the fibres used in cloth making should be studied. The domesticated sheep, whose ancestors once roamed wild over the mountains of Southern Europe, is the principal and

MOST IMPORTANT

source of supply, and the various breeds furnish wools from the finest Saxony to the extremely low-grade, coarse and hair-like carpet wools. In its wild state the fleece of the sheep was thickly interspersed with long, coarse, hair-like fibres, but care and attention to breeding has practically eliminated these, and in well-bred flocks they have disappeared rapidly. Sheep are commonly classified as long and short wooled varieties, a peculiar feature connected with the classification being the fact that the physical characteristics of these divisions show as great divergence as do the fleeces. The long-wooled varieties are usually of large body, while the short-wooled sheep are smaller, and lighter in weight, often with brown or black face and legs. Some of the best-known varieties of long-wooled sheep are the Cotswolds, Lincolns and Leicesters.

LINCOLNS THE HEAVIEST.

Of these the Lincolns produce the heaviest fleece and the longest wool, a not unusual weight for a single fleece being 18 to 20 pounds with a staple 20 inches in length. The Cotswold usually averages about ten pounds to the fleece, but much heavier fleeces are not at all uncommon. The Leicester is somewhat smaller than the two previously named breeds, with a shorter and lighter fleece. The varieties of short-wooled sheep best known, perhaps, are the Southdown, Hampshire Downs and Shropshires of the English breeds, the Saxony of Germany and the various merino types scattered over the world. The Saxony wool is the finest in the world. The fibre is covered

with innumerable fine scales or serrations, which make it a particularly good felting wool.

Australian wools are of excellent quality, the finest termed Botany, then Port Philip, Sidney and Adelaide. These are all of the merino type, as

Lincoln Ewe.

are the domestic wools of the United States. The principal classes of

DOMESTIC WOOLS

are the fleece wools, or, as they are sometimes termed, washed fleeces, bright wools, territories, Texas and Californias. Oftentimes the bright wools are included with the fleeces, though of a somewhat different character. The Ohio, Pennsylvania and Michigan fleeces approximate very closely the Australian wools in fineness and felting properties, while the bright wools are slightly coarser and more lustrous. The territory wools are about the same grade as the fleeces, the name being derived from the fact that they are produced in the states in the West and Northwest which were under territorial government for many years. The shrinkage of these wools is very heavy, in some instances being as high as 75 per cent or more. This is not due entirely to the natural grease or yolk contained in the wool, but to the large amount of dirt and foreign matter which clings to the fibre. Texas wools are fine and felt readily, as do the Californias. A considerable portion of the

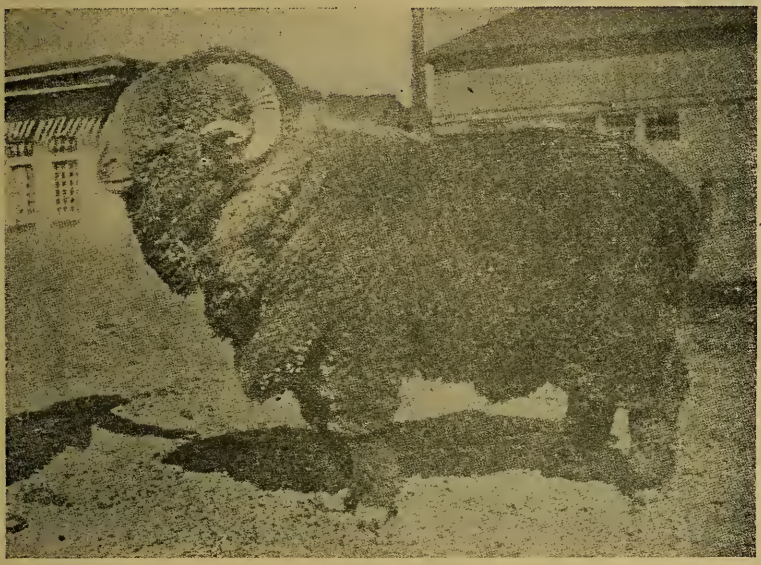
CROSSBRED WOOLS

are grown in South America, though the Montevideo is fine and resembles the Australian in character. Asiatic wools are, for the most part, very coarse, and are used to a great extent for carpets. Next in importance to the sheep as a source of textile fibres is the Angora goat, whose fleece is known as mohair.

This is a long, white, silky fibre with a bright metallic luster. An extremely soft fibre is shorn from the cashmere goat and is invaluable for the production of certain types of soft, fine textiles. This animal is a native of a section of India, from

which it receives its name. The alpaca is of the llama tribe, and is indigenous to the mountainous regions of southern Peru. The fibre resembles mohair, and is especially distinguished for its luster, softness and extreme length of staple.

Another important fibre is camel's hair, the greater part of the supply coming from China and Russia, the former country furnishing a much superior grade. This stock is largely



American Merino Ram.

used for combing, the noils being used for the manufacture of carded yarns for dress goods purposes. In recent years there has been a considerable quantity of calves' hair used in making certain types of fabrics.

There is a very material difference between the

PHYSICAL STRUCTURE

of wool and hair, and herein lies the vast difference in the action of the fibres during the process of manufacture. Wool is soft, wavy and curly, flexible and elastic. Under the microscope it appears as a cylinder, with a surface covered with minute scales, or imbrications of irregular sizes, overlapping each other, and tapering from root to tip. The growth is in a mass of fibres, termed locks, while hair grows, each fibre separate, with a smooth, flat surface. The number and fineness of the serration of the wool fibre determine largely its felting properties, therefore, it will be readily understood that the preservation of these imbrications intact during the manufacturing process is extremely important. In its natural condition these scales or serrations of the wool fibre lie very close to the body or main stem, but under the influence of moisture they become soft and pliable and extend at an angle which permits the serrations of other fibres to become interlocked with them, forming a compact mass. An idea of the extreme fineness of the fibre may be gained from the fact that there are from 2,700 to 2,800 serrations per inch in Saxony wool, while 1,900 fibres will lie side by side in one inch. In general, it may be said that the best wool is that having the most serrations per inch, and that such

wools possess the greatest felting properties, but there are exceptions.

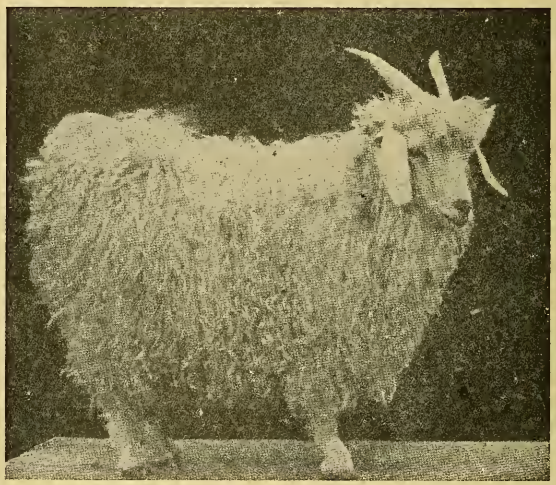
Under the microscope Cape wools apparently conform to all the requirements of a fine felting wool, as does the Buenos Ayres, but the fulling value of these is much inferior to the Port Philip, which has a very similar mechanical structure. To the serrations and the fact that the center of the fibre is hollow is due the fact that wool has an exceptional capacity for absorbing and retaining coloring matter. A very important and useful class of fibres are the so-called wool substitutes. Many writers in the public press have attempted to create the impression that it is unnecessary and harmful to use these, but such is not the case. They each have a

FIT AND PROPER PLACE

in textile manufacture. Among the most valuable of these are the various by-products resulting from the manufacture of worsted yarns. Of these, noil is the short fibre removed by the comb, and is a very valuable stock for use in producing carded woolens. It is produced in a variety of grades, and is usually mixed with other stocks, though many times it is used alone for the production of desired effects in woolen goods. Many very desirable fabrics are manufactured from mohair and camel's hair noil, the production of which would be impossible without their use. Thread waste is opened and teased apart into loose fibres by means of the garnett machine, and for manufacturing purposes is far superior to much of the new wool. No little of the present agitation relative to the use of these wool substitutes is the work of those who have but a

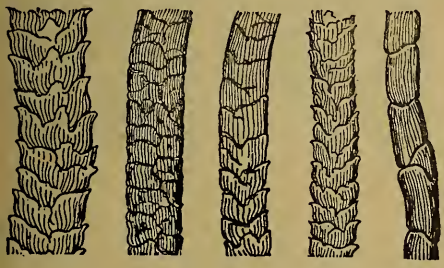
SUPERFICIAL KNOWLEDGE

of the subject, and whose diatribes should have absolutely no weight. Probably the statement of the case by the eminent English authority, McLaren, is one of the best ever written. During the course of a lecture on textiles he said: "A few words must here be said on remanufactured fibres, known to the world under the common name of shoddy. There are few more unreasonable and foolish prejudices than that against shoddy, and so far from it being a term of reproach, it should really be one of praise, for the man who first brought shoddy into use has conferred an incalculable benefit on the world, and enabled millions of persons to be



Angora Goat.

warmly and cheaply clothed, who must otherwise be shivering with cold. It would be as unreasonable to despise paper makers because they use up linen rags, or dyers who use up colors made from coal tar as to despise manufacturers who use up waste woolen rags as shoddy. It is said



1. 2. 3. 4. 5.

No. 1, Medium Grade Wool Fibre. No. 2, Camel's Hair. No. 3, Kemp, or Diseased Fibre. No. 4, Merino. No. 5, Mohair.

that 125,000,000 pounds of shoddy, mungo, etc., are manufactured into cloth every year in England alone. If this immense quantity were wasted, it is difficult to estimate the increase which would take place in the price of wool and the

CONSEQUENT DEARNESS

of cloth, but the result would be that countless persons would be unable to afford proper clothing." The stock known under the name of shoddy is manufactured from woolen rags, and is simply wool that has been used for manufacturing cloth, then reduced to fibre for the purpose of remanufacturing. The staple is not so long as that of the original wool, but it may be used to good advantage in the production of many cloths. There are a variety of fabrics containing shoddy, whose wearing value would not be in the least improved were the shoddy replaced by the finest of fleece wool. Flocks are very short fibres, removed from the cloth by gigging, fulling or shearing. They are but little used except in the making of very low-grade goods.

Card waste, as the name indicates, is made during the carding process, and is reworked into cheap fabrics. Extract is a form of shoddy made from rags containing cotton from which the vegetable fibres have been extracted or removed by treatment with chemicals, usually sulphuric acid. This process, known as "carbonizing," is also used to a considerable extent for freeing wool from burs and other vegetable impurities. The method in common use is to provide a lead-lined tank to hold the carbonizing bath, into which a cage containing the material to be treated is lowered and completely submerged for a sufficient length of time to allow the acid to thoroughly penetrate the mass.

REGARDING THE BATH.

The bath should be made with pure water, and acid sufficient to register from four to six degrees Twaddell. The cage is removed from the tank, the material extracted in an extractor used for no other purpose, with a galvanized basket, and provided with a suitable well, so that the liquor may be returned to the tank. The stock is then subjected to a heat of about 180 degrees Fahrenheit, which reduces the vegetable matter to carbon. From the dryer the stock is taken to the carbonizing duster, where it passes between crush rolls, reducing the impurities to powder, which the action of the fan and beater of the dusting machine effectually removes. Unless the stock is to be immediately dyed, it must have an alkali bath to neutralize the effect of the acid treatment. No reference has been made to fur, as this is a fibre seldom or never used in textile manufacturing except in the making of felts. Its physical structure is somewhat similar to wool, having some imbrications and good felting qualities, but is not easily spun.

Mungo is a fibre manufactured from hard felted woolens, such as broadcloths, overcoatings, etc., and has very little length with practically no felting properties. It is, next to flocks, the lowest type of wool substitute which it is practical to use in cloth making.

Wool Sorting and Scouring

The first operation through which wool passes in the course of manufacture is the sorting. This does not mean that the fleeces are separated according to quality, but that the individual ones are spread upon a suitable bench or table and the various grades of wool contained in each separated from each other and placed in receptacles provided for that purpose.

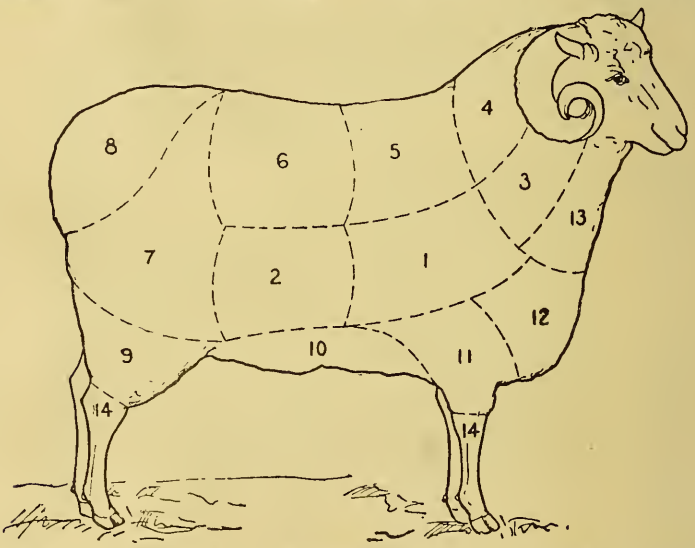


Figure 1. Variety of Wools in Position in Which They Grow.

The tools required are few and simple, aside from the bench with its screen top, which allows loose dirt, straw or other foreign matter to drop through, a pair of wool sorter's shears for clipping off paint, tar, or burrs, being the only implement needed.

During the colder months it will be necessary to provide a rack, with steam pipes underneath, on which the fleeces may be piled to warm before they are sorted. This is necessitated by the fact that in cold weather the yolk or natural grease in the wool becomes so stiff that unless warmed the fleeces cannot be opened out flat on the bench without tearing them apart. The fleece of a sheep, after being sheared and before sorting, resembles the form or shape of the sheep. Figure 1 gives an idea of the various qualities or sorts that can be taken from a single fleece. It must be understood that wool from every variety and breed of sheep differs according to whether the fleece is from a coarse or fine breed, whether it is a cheviot or merino sheep, and that each fleece contains many grades of wool, in fact, the variation in a single fleece may be as great as that between wool from two distinct varieties of sheep. Figure 1 is numbered to show the variety of wools in the position in which they grow and described by McLarin in this manner:

"No. 1 is the shoulder, where the wool is long and fine. It grows the closest and is most even.

"No. 2 is rather stronger, but otherwise equally good. The best and soundest wool grows on these parts.

"No. 3, on the neck, is shorter than No. 1, but even finer; where sheep are likely to have gray wool it is sure to be found here, and also on No. 4, which, with No. 5, grows wool of inferior staple and faulty character. No. 6, which covers the loin and back, is coarser and shorter, while on

"No. 7 the wool is long, strong and hangs in long staples. On crossbred sheep this part becomes very coarse, and is much the same as

"No. 8, which is the coarsest part of the wool, and is known as bruch, or britch, and even when very strong, as 'cowtail.' When like this it almost resembles horse hair, although it is more brittle and not so smooth and bright.

"No. 9 is also strong and much the same as No. 7.

"No. 10 is short, dirty and increases in fineness as the front legs are approached; it is known as 'brokes.'

"No. 11 is also short and fine, while

"No. 12, the front of the throat, is short and worn with rubbing. Kemps or dead hairs are mostly found in No. 12 and No. 8, although in the latter they are much longer and stronger than in the former.

"No. 13 is the head, on which the wool is very short indeed, rough and coarse like the legs.

"No. 14 is still worse and of little value."

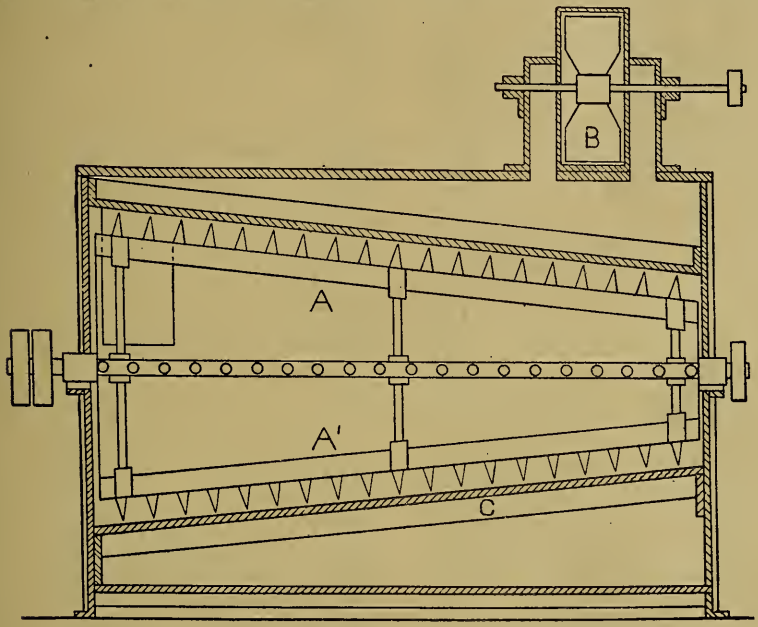


Figure 2. Sectional View of "A Cone Duster" or "Willow."

It will be readily seen from the variety of wool to be found in a fleece that none but

SKILLED WORKMEN

can sort wools with accuracy. With the skill acquired by long practice, the eye and hand of the sorter follow the divisions according to the number of qualities required. At times it may be necessary to make six to eight sorts, while at other times two sorts are all that are required, with the britch thrown to one side. The type

of goods to be manufactured will determine to a great extent the closeness to grade required of the sorter. In a few instances the fleeces are simply skirted, the fabrics requiring no further sorting of the stock.

WOOL SCOURING.

Wool scouring, as carried on in most modern plants, is very different from the primitive methods employed by our ancestors, and even to-day in some remote parts of the world. It was the custom to carry the wool to the side of a brook, and there remove as much as possible of the dirt and grease by manipulating in cold water, aided by herbs and barks. Later, methods of making soap were discovered and the stock was more thoroughly cleansed by the use of soap and water, but the process was still extremely slow and laborious. When the old style rinse box, so familiar to many of the older generation of mill men, was devised, it marked a long step in advance in this process. The wool was thrown into a tub or vat containing the scouring liquor, poled for a time to secure thorough penetration of the mass, then forked out onto a rack to drain. Under the rack a suitable shelf was placed to provide for the return of the scouring liquor to the tub. After draining for a time, a portion of the wool was thrown into the rinse box and a stream of water turned on which more or less thoroughly washed the impurities of various kinds from the stock.

When clean, the wool was taken from the box, allowed to drain for a time and then spread thinly on a rack to dry. These methods have been practically superseded in all mills of any size by the

MECHANICAL WOOL WASHER,

which is not only a great saver of time and labor, but also cleanses the wool thoroughly and leaves it in much better condition for subsequent operations. In the majority of instances it is advisable to dust the wool before scouring, removing in this way as much as possible of the mechanically adhering dirt and refuse, making a considerable saving in the quantity of detergents necessary to complete the cleansing of the fibre. There are several types of dusters in use for this purpose, one of the most commonly used being that known as a "cone duster" or "willow." A sectional view of a duster of this type is shown in Figure 2.

The cylinder is cone shaped and consists of four lags, supported by suitable spiders on a main shaft, and is usually about 48 inches in diameter at the large end, tapering to 26 inches at the other. The lags A and A' are

FITTED WITH IRON TEETH,

projecting 3 to 4 inches which mesh with stationary teeth set in the frame of the machine. The lighter particles of straw, chaff and dust are withdrawn by the exhaust fan B and discharged through a pipe outside the mill. Below the cylinder is a screen C through which the heavier impurities such as sand and dirt fall. A screen is also placed at the fan openings to prevent the wool from being drawn through with the light dirt.

In action the stock is placed on a slat apron which delivers it to a pair of cockspur feed rolls, which hold it momentarily while it is opened and beaten by the turn of the cylinder revolving at the rate of 400 turns per minute. The bottom of the duster should be as nearly air-tight as possible, so that there may be no upward draught of air, caused by the suction of the fan, to prevent the falling of the dirt and refuse through the screen. The screen is usually made in at least

TWO SECTIONS,

so that it may readily be removed for cleaning. The action of the revolving cylinder carries the wool toward the large end where there is an opening through which it is discharged. In arranging a plant for dusting, scouring and drying, if the room is not long enough to permit of the machines being placed tandem, it is possible to so arrange them that handling of the stock will be reduced to a minimum.

In order to accomplish this the various machines may be located as in Figure 3. The wool is fed to the duster A by hand and discharged onto an apron running at right angles which delivers the wool to the feed apron of the three-bowl washer. From the delivery end of the third bowl it passes to an inclined apron E, which delivers it to the feed apron F of the dryer G. The dry stock from the opposite end of the dryer falls to an apron H, which travels toward the blower of the pneumatic conveyor I, which transfers the dry wool direct to the bins in another room. An installation of this sort will give a maximum production with a minimum of labor. Tanks for boiling the soap should be arranged where they would be easy of access and not occupy space that could be used more advantageously for other purposes.

In scouring wools the detergents to be used should be selected not alone with a view to removing the dirt and grease from the wool, but also with the object of leaving the fibre in the best possible condition for further manufacture. For scouring wool there is nothing better than a pure, well-made potash soap, the so-called

FIG OR CROWN SOAP

While many scourers use soda soaps, their use is not advisable on fine wools, as the action of a harsh alkali has a very injurious effect on the wool fibre. The tendency is to destroy the fine serrations or imbrications of the fibre, which detracts materially from its working qualities. The use of soda also has a tendency to give the wool a yellow tinge, if it is allowed to lie for some time before it is used. Before using any scouring materials they should be tested for purity and strength, not alone to be sure that they contain no impurities that have no value as detergents, but also to make sure they contain nothing actually harmful to the wool fibre. Some of the

MOST COMMON ADULTERANTS

are china clay, salt and silicate of soda or resin. A few simple tests should be familiar to everyone. Excess of moisture, a very common method of loading soap, is easily detected by carefully weighing a sample of soap and then cutting it into thin shavings, drying until it ceases to lose weight and weighing again. The difference in weight is the amount of moisture it contains. If one ounce of the soap is dissolved in water, placed in a test tube and a quarter of an ounce of dilute sulphuric acid is added, the soap will be decomposed. The grease and resin, if any, will float on the top, and the earthy, heavy impurities settle to the bottom. By heating a portion of soap in strong alcohol, the soap will be dissolved, leaving the insoluble impurities in their original form. As it is a matter of common knowledge that caustic alkali of sufficient strength will entirely

DISSOLVE THE WOOL FIBRE,

it should hardly be necessary to emphasize the fact that its presence in soaps for wool scouring should be carefully guarded against. Its presence is readily determined by an extremely simple test. A drop of phenolphthalein placed on the soap will immediately give a pink color if it contains free caustic alkali.

In addition to pure detergents, it is absolutely essential that there be an adequate supply of pure soft water. If hard water is used for scouring wools it is well-nigh impossible to obtain satisfactory results. The most common forms of impurities are the various iron and lime compounds. The result of using such water will be to decompose the soap, and the grease in it will unite with the acid of the lime salt forming a lime soap, which is insoluble in water. This lime soap, in the form of a sticky, pasty mass, will be deposited on the wool in the scouring liquor, and is removed with extreme difficulty. If the wool is not thoroughly cleansed from it at this time, succeeding operations will be attended with considerable trouble. This will be particularly noticeable in the dyeing and finishing departments.

THE IDEAL METHOD

of wool scouring is that which thoroughly cleanses the fibre, without in

the least detracting from its color, strength, luster or elasticity. These results are impossible of attainment without the best of materials, machinery and care in operation. The formula for the scouring liquor will vary with the class and condition of wool to be scoured, and cannot be laid down as an ironclad rule to be used in all cases.

In many mills it is customary to make the soaps used, and excellent results may be obtained by so doing. The formula here given will make a very satisfactory soap for wool scouring.

Dissolve 400 pounds of caustic potash in 100 gallons of water. Boil until it is thoroughly dissolved, then add water to make up 400 gallons giving a solution of a pound of potash to a gallon of water. Let the solution cool to about 65 degrees Fahrenheit, when it should test about 14 degrees Twaddell. Run the lye into barrels and add a gallon of red oil to each four gallons of the solution, stirring occasionally until the ingredients are combined, forming a jellylike soap. To prepare the scouring liquor, place in a suitable tank 125 pounds of soap, 200 pounds of pearl ash, and boil in 250 gallons of water, until the mixture is completely dissolved. In using a 16-foot bowl machine for very greasy wools 12 pails of this mixture should be placed in the first bowl, 10 in the second and clear water in the third. The temperature of the liquor should never be over 125 degrees Fahrenheit and preferably lower, as excessive heat will injure the wool fibre; in fact, at a temperature of 230 degrees Fahrenheit the wool will be decomposed With these facts in mind, the necessity for skill and intelligence in scouring wool will be readily understood. The strength of the scouring liquor to be employed should be determined largely by the

GRADE OF THE WOOL,

rather than by its apparent grease content, and must be left to the judgment of the scourer. In drying, the wool should not be subjected to the action of extreme heat, as it has a tendency to detract from the working qualities of the stock and the handle of the finished fabrics. When time and space will permit of so doing, better results will be obtained by drying the wool without the aid of artificial heat. This is readily accomplished by providing a suitable screen, supported by racks and enclosed below so as to be practically air-tight. A powerful fan is connected with the space underneath the screen and forces a current of air through the stock. Wool dried in this manner is more lofty, and retains to a greater degree its life and elasticity.

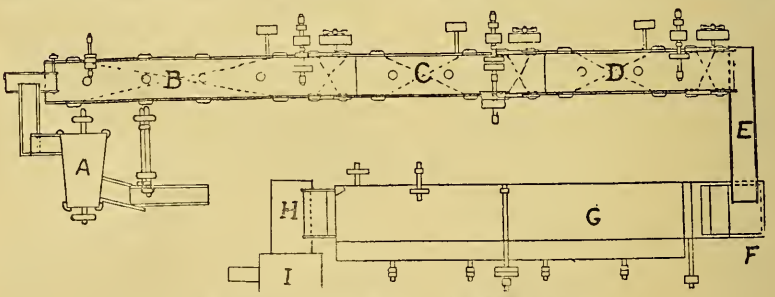


Figure 3. Location of Machines.

CARBONIZING.

Should the wool contain an excessive amount of burrs and other vegetable matter which may not readily be removed, the scoured wool may be carbonized and the impurities removed in this way. There are various methods of carbonizing, one of the most common being the wet or acid

system. In carbonizing by this system a lead-lined tank is provided containing a bath, usually of dilute sulphuric acid of a strength of four to six degrees. In this the wool is immersed by means of a wooden cage into which it is packed, not too tightly, as every portion must be subjected to treatment by the acid. After a suitable time has elapsed, depending on the quantity of vegetable matter in the wool, the cage is raised to drain, the wool extracted and subjected to about 180 degrees of heat, which renders the vegetable matter capable of being crushed into dust and easily removed by the carbonizing duster. Wools which have been subjected to this treatment must be neutralized by means of an alkali bath, unless they are to be acid dyed.

Wool Mixing and Carding

To insure good results in carding and spinning it is necessary that the preparation of the stock in the previous processes be thoroughly performed. In a former article we have taken up the sorting and scouring of the wool and at this time will follow the course of the stock in its progress through the regular routine of oiling, picking, carding and spinning, leaving the dyeing to be treated in an article particularly devoted to that branch of the industry.

To card well, the stock must be as free from vegetable matter as possible, and unless this is removed by the carbonizing process, the stock should be run through the bur picker, which will remove a large proportion of the burs, shive, seeds, etc., before the stock is oiled and mixed. A common type of bur picker is shown in the illustration, reference to which will show the means of separating the burs from the fibre. The stock is fed to the feed apron, a, by the ordinary type of self feed, and conveyed in a continuous flat web to the cockspur feed rolls, A, which hold the stock while it is engaged by the cylinder B This cylinder

SERVES A DOUBLE PURPOSE,

that of opening the wool and also carrying it to the bur cylinders d and e, which are covered with toothed steel rings that allow the wool to be drawn into the spaces between the rings, but hold the burs on the surface, where they are engaged by the bur guards F, G, and knocked out by the rapidly revolving blades. The wool is cleared from the bur cylinder by the brush H, and carried into the gauze room by the current of air generated by the brush. Under the cylinder is a screen, C, permitting the heavier particles of dirt and refuse to fall into the enclosed space under the machine, while the lighter particles are drawn through a screen at the back by the fan, and discharged outside of the mill through a suitable pipe. The burs are thrown into a box, J, on top of the feed apron.

It may be thought strange that after spending so much time and trouble to remove the natural grease from the wool, oil should be put on the fibre before proceeding with its manufacture into yarn, but there is an extremely simple explanation for this operation. In the article on textile fibres it was stated that one of the most important features of the wool fibre is the scaly form of the outer surface, and it was also stated that on these scales or imbrications depends, to a great extent, the

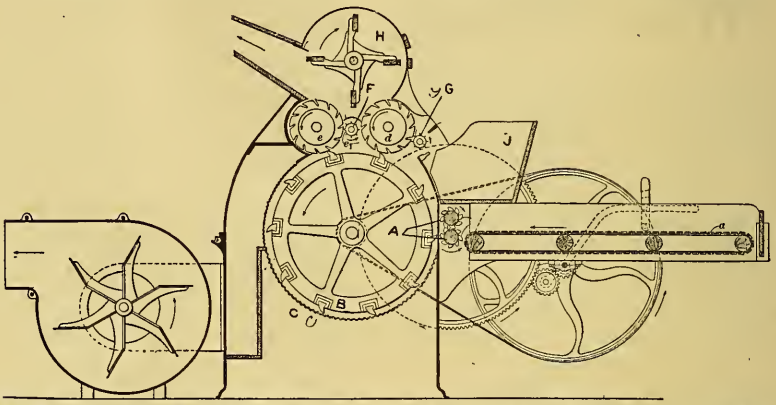
VALUE AND FELTING

properties of the stock. Should the wool be carded while dry, these serrations will be injured by the friction of the fibres with each other, and by contact with the card clothing. The

fibres will be broken, causing a much larger percentage of waste. When lubricated with an emulsion of oil and water, the imbrications are filled with the lubricant and slide by one another easily, allowing the locks of wool to be straightened out and disentangled without injury or difficulty. It is impossible to restore to its original condition wool that has been damaged by harsh treatment in the scouring or drying process, but the use of good oil in liberal quantities will assist materially in the carding and spinning. The oil is usually applied in the form of an emulsion, obtained by mixing oil and water and saponified by an addition of a mild alkali. The kind and quantity of oil to be used varies with the stock, a harsh, crisp wool requiring more oil than a fine, soft stock. The usual quantity of oil for a medium grade of stock is four quarts per hundred pounds. The stock to be oiled is placed in thin layers on the floor of the picker house, and the emulsion applied with a sprinkler can. This method is probably the most commonly used, although in up-to-date plants, it is not unusual to find a

MECHANICAL OILER

which applies the emulsion just as the stock enters the mixing picker, or in some types as it emerges. The method of application is of no particular importance, the essential feature being that it shall be applied evenly to all parts of the batch, or uneven work in subsequent processes will be the result. Another very important item, if mixtures either of colors or stocks are to be made, is to see that the batch is so laid down that a homogeneous blend will result. This may be best accomplished by placing alternate layers of the various colors in proportion to the quantity of each and in feeding to the mixing picker, using care to take the stock from top to bottom of the pile. In this manner each armful fed to the picker will contain its proportion of every color used. If the mixture contains several colors or stocks, it would be well to give it at least three runs through the picker. We illustrate a modern type of mixing picker, which will give the reader an excellent idea of the machine and its



Atlas Bur Picker—a, Feed Apron; A, Feed Rolls; B, Main Cylinder; C, Screen; d, e, Bur Cylinders; F, G, Bu r Guards; H, Brush; J, Bur Box.

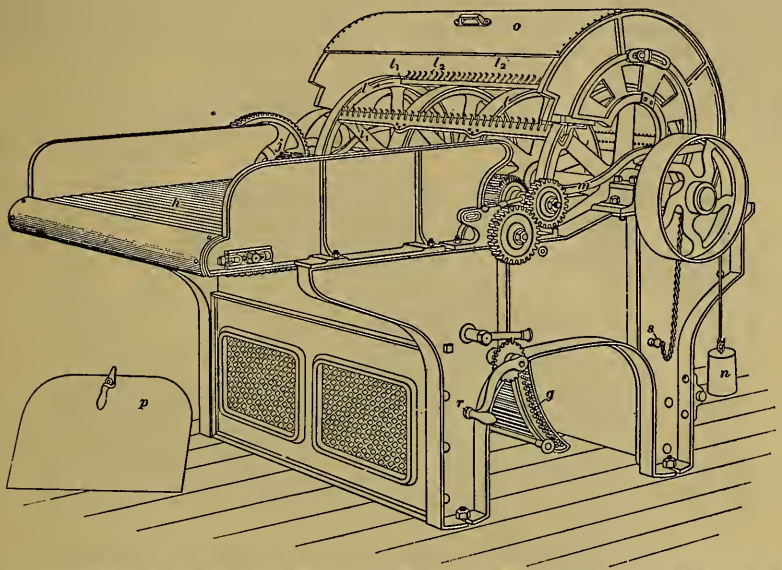
METHOD OF OPERATION.

The stock is fed to the traveling apron, which conveys it to the feed rolls. These are fitted with pin or cockspur teeth which hold the stock momentarily, while it is engaged by the teeth of the main cylinder which revolves at a speed of from 700 to 1,000

revolutions per minute. The stock is discharged through an opening directly opposite the feed rolls into a gauze room, or to a blower which conveys it to the desired receptacle.

Oiling and mixing, which, of themselves, are apparently simple operations, requiring no special care or attention, are, in reality, a very important part of cloth manufacture. Unless the stock is well handled in the picker room, no amount of time and labor which may be expended later will remedy the evils resulting from this inattention. It is a common saying among woolen superintendents that stock which leaves the picker room in first-class condition is well on the way to perfect cloth, while stock poorly treated in the picker room will give trouble in every subsequent process.

From the picker house, the stock may be conveyed to the card room by any means at hand. The system involving the least labor, perhaps, is to have the picker discharge direct to a blower connected to a pneumatic system, which deposits the stock in a suitable bin convenient to the self feed of the card. If this is not permitted from lack of space, or other good reason, the batch may be sheeted up and taken to the card room as needed. At the present time there



Mixing Picker—g, Screen Under Cylinder; h, Feed Apron; j, Feed Rolls; l, Cylinder; l2, Cylinder Teeth; o, Cover.

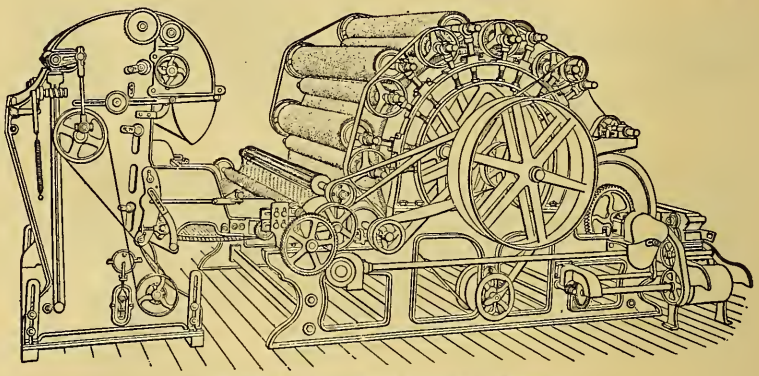
are few mills, if any, which are not fitted with self feeds in the card room. This is not only a

LABOR-SAVING DEVICE,

but insures much evener results than it was possible to obtain by the old method of feeding by hand. The illustration shows a modern first breaker card with self feed attached, as commonly used in woolen mills. The essential features of the feeding are a receptacle for the stock, a spike apron to convey the stock to the weighing mechanism, suitable means to dump the required weight of stock on the feed apron, and means

by which it is possible to prevent a further supply to the scale pan when the required amount has been received. The operation of the machine is not difficult to comprehend, and is marvelously accurate in its results.

It is built with a large hopper or feed box, in the back of which is a spiked apron for conveying the stock from the hopper to the scale pan. Near the top of the apron, the stock comes in contact with an oscillating comb, which removes the surplus wool, leaving the balance distributed evenly over the apron. On the opposite side of the apron, a rapidly moving,



First Breaker Card and Self Feed.

short, stripper apron sweeps the wool from the spike apron into the scale pan. When the desired weight of wool is deposited in the scale, the sinking of the pan raises an arm which engages with suitable levers and stops both the spike and stripper aprons. By means of a lever operated by a gear driven from the feed apron, the scale pan is opened and the wool deposited on the feed apron of the card. The empty pan then is lifted by the counterpoise disengaging the stop mechanism, and the operations are repeated. With the placing of the stock on the feed apron of the first breaker card, the process of carding really begins. The objects of carding are threefold: the opening out of the fibres of the wool, the completion of the mixing begun in the picking process, and the arrangement of the mass of wool into suitable form to be spun into yarn. In olden times these operations were all performed by hand, but the inventive genius of man has perfected machinery that now enables us to obtain much better results, with practically no handling of the stock from start to finish. Modern carding involves the use of three machines, with the necessary accessories in the way of feeding mechanisms and doffers. The two

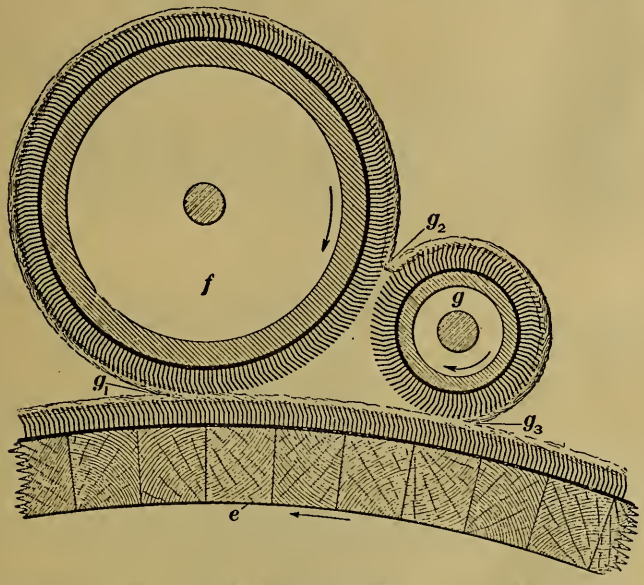
PRINCIPAL FEATURES

of carding are: The carding itself, which consists of opening and carding the wool by means of revolving cylinders covered with card clothing filled with wire teeth, the carding action taking place when the teeth of two opposing cylinders work point against point; the stripping of the carded web from the cylinder by the points of the clothing on one cylinder, working against the backs of the teeth on the other. On an ordinary set of 48x48 cards there are usually six workers on the first and second breakers, and five on the finisher. The illustration shows the method of action of a worker F, and stripper G, in connection with the main cylinder E, of the card, giving a clear idea of both the carding and stripping. At the rear of the last

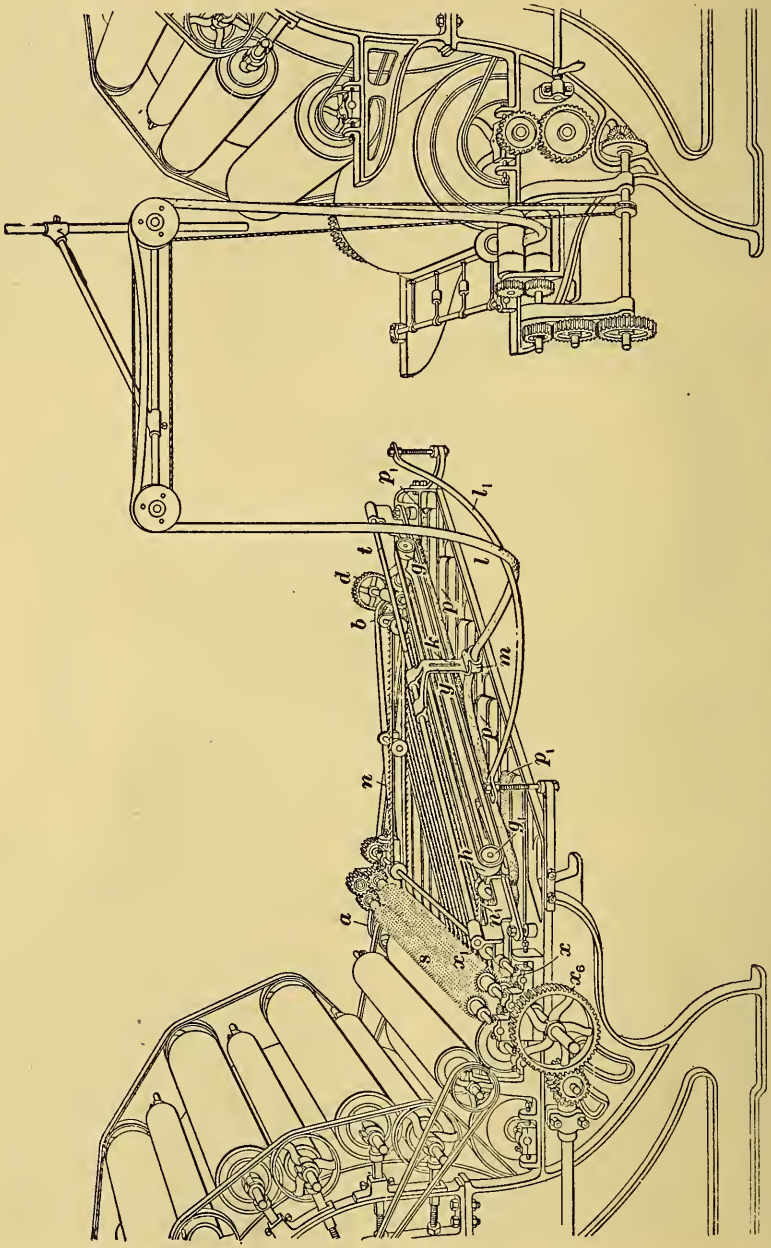
worker on each card is a roll covered with longer wire, which has neither a carding nor stripping action, but acts

MORE IN THE NATURE

of a brush. The surface speed is slightly greater than that of the cylinder, and the clothing raises the stock to the points of the teeth on the cylinder from which it is rapidly removed by the doffer. An oscillating comb at the back of the doffer removes the stock in a continuous web, which is drawn off at the side through a tube by suitable rollers, and usually conveyed to the second breaker in rope form by the Apperly feed, thus eliminating the use of the old style creel. The second breaker card is not essentially different from the first breaker, usually the clothing is finer, and it may be set somewhat closer, the action being virtually the same, continuing the carding and completing the mixing of the stock. In appearance it differs somewhat because of the change in the method of feeding. The illustration shows the back of the first breaker and the Apperly feed applied to the second breaker and is sufficiently clear to require no detailed explanation. From the second breaker, the stock is transferred to the finisher by a similar feed and is subjected to still further carding. The chief point of difference between the finisher and the two breaker cards is at the delivery end. Instead of delivering the stock in rope form from a single doffer, the finisher is provided with two ring doffers. The rolls are not entirely covered with card clothing but have alternate rings of clothing as shown in the cut. The doffers are so arranged that the portion of the cylinder not stripped by the upper rings comes in contact with the clothing of the bottom doffer, and the web is divided into ribbons which pass through the condenser, where they



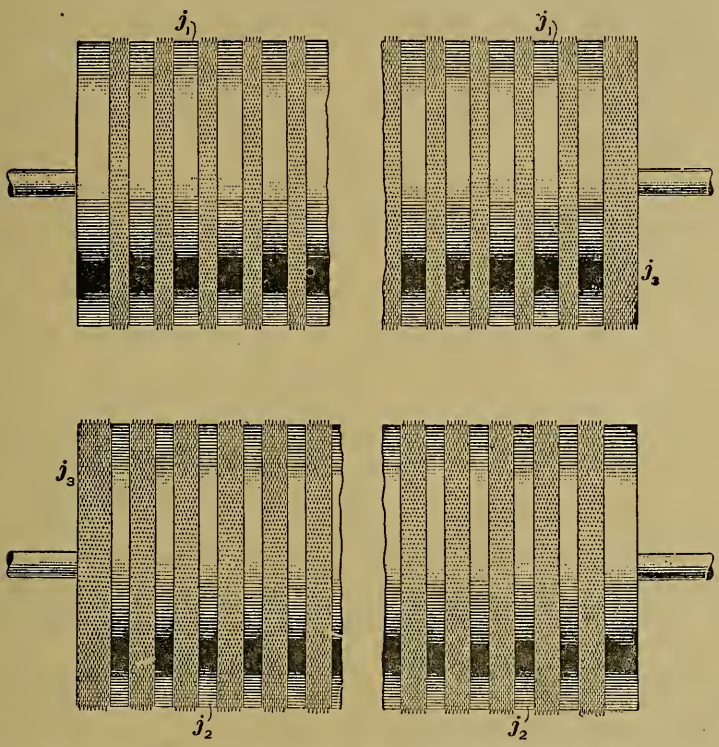
Side View of Cylinder, Worker and Stripper—f, Worker; g, Stripper; g1, Web Taken by Worker; g2, Web Removed by Stripper; e, Cylinder; Arrows Indicate Direction of Movement.



Apperly Feed Between First and Second Breakers.

are subjected to a reciprocating motion, and rubbed into threads termed roving, which are wound on spools ready for the spinning room.

The importance of care and accuracy in setting the various parts of the card cannot be too strongly impressed upon the operatives, as in case these are allowed to enter the cards with the stock, the wire becomes bruised and bent, and is rendered totally incapable of performing the functions for which it was intended. The care and setting of the



Ring Doffers on Finisher Card—j1, j2, Empty Spaces; j3, Waste End Rings.

emphasized, as inattention to these details will result in serious injury to the stock, as well as irreparable damage to the card clothing itself. The necessity of removing burs and lumps of foreign matter cannot be too

various parts of the cards cannot be taken up in the brief description of the process here given and belong in a more technical treatise of the subject than space at this time will allow.

Woolen Spinning

There are probably very few of the present generation who have seen wool spun on the old fashioned wheel, so commonly used in our grandmother's day. It is only a few generations ago that the women of the household were accustomed to spin the various fibres into yarn, and weave, on a primitive type of hand loom, not only the cloth for the garments of the family, but the linen for the table and bedding. It is less than one hundred and fifty years ago that the first machine for spinning more than one thread at a time was invented by James Hargreaves. This was a wonderful improvement over the process then in vogue, and the perfection of the jack by Samuel Crompton in 1779 apparently left nothing to be desired. It would be extremely interesting to listen to the comments these pioneers in the industry would make, could they be translated to a modern spinning room, with its

SELF-ACTING MULES,

of some 560 spindles each, operating at a speed of three draws per minute. The production of one of these mules, 1,680 yards of yarn per minute, would certainly appear to them as but little short of marvelous. For the greater part of a century, the hand jack was the type of machine used in the woolen mills. This machine, while a vast improvement over former methods, was somewhat slow and laborious. The minds of many skilled mechanics were engaged on the problem of increasing the efficiency of the jack by modifications and improvements that should make it automatic in its action. The use of the hand jack required the spinner to wind the yarn, and form the bobbins by hand, as indicated by the name of the machine, while in the modern type of mule, as built by both foreign and domestic manufacturers, the action is automatic throughout. All that is required of the operative, practically, is to keep it supplied with roving, remove the full bobbins, place a set of empty bobbins on the spindles and start the mule. The spinning process consists of

THREE OPERATIONS,

drawing out the roving, inserting the required amount of twist and winding the thread on the bobbin. In a previous article the carding of wool was described, ending with the winding of the roving on jack spools, in which condition it is taken to the spinning room, ready for the mules.

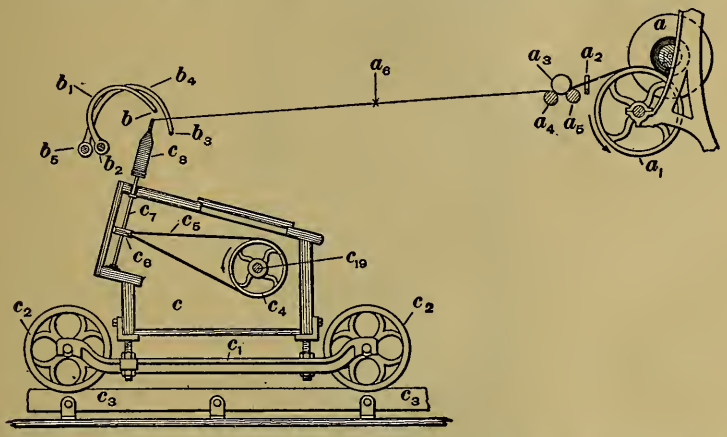
The method of operation may be briefly described as follows: A portion of roving is unwound from the spool, drawn and twisted to the desired size and wound on bobbins or tubes, for ease of handling in subsequent processes. The mule has as its principal features, three distinct parts, each of which are intimately connected with the successful performance of the work. These are the carriage, the head stock and the mechanism for supplying the roving.

The carriage travels in and out automatically and carries near its outer edge the spindles which are driven from a sectional cylinder, extending the length of the carriage, by cotton bands. Its motion is controlled by the headstock, from which every movement of each part of the machine is governed by means of suitable gears and cams. The line drawing gives a very clear idea of the various parts and their relative positions. The spool of roving, A, is placed on the drum, A1, the ends passed through the guide, A2, which keeps them in the center of the bosses on the drawing off rolls, A4 and A5. The outer end of the roving is then fastened to the bobbin, C8, on the spindle, C7. The lower pair of delivery rolls are driven by a train of gears from the roving drum, A1, which in turn is driven from the headstock. The spindle is supported by

means of a "stepboard" at the lower end and a "collarboard" at the top of the carriage, and has a slight inclination toward the delivery rolls. About midway between the step and collarboards is the whorl, C8, a small grooved pulley, around which the driving band passes. In former years each spindle was driven by a single band, but the approved method at present is to drive

ONE OR MORE SECTIONS

by a band passing around a spindle and the cylinder alternately. The motion, usually 72 inches, and remains there until sufficient twist has been inserted. When this has been accomplished, the fallers assume the proper position, the carriage is drawn in, winding the yarn on the bobbins at the same time. To one not familiar with the machine it would seem that the roving would be immediately broken by the rotation of the spindles. The fact that the point of the spindle is slightly below the level of the delivery rolls, together with its inclination permits the yarn to slip off over the top

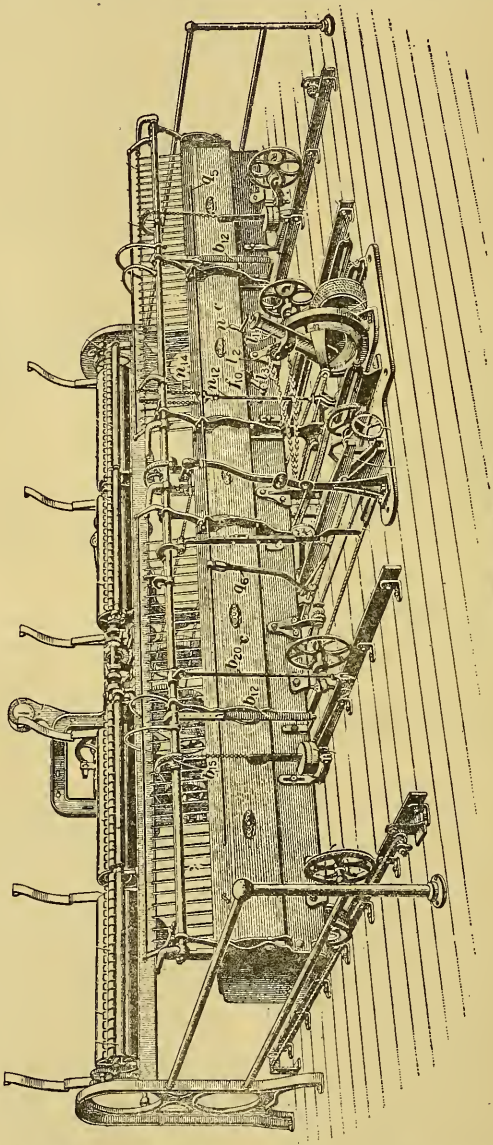


End View of Mule.—a, Spool of Roving; a1, Roving Drum; a2, Roving Guide; a3, Sectional Top Roll; a4, a5, Delivery Rolls; a6, Thread; b1, b4, Fallers; c7, Spindle; c8, Bobbin; c4, Cylinder.

arms, B1 and B4, termed "fallers" carry wires which serve to keep the yarn taut, and guide it while winding on the bobbin. The operation will be more readily comprehended if the description follows the action from the beginning of a draw. When in this position the tops of the spindles are slightly below and about an inch from the delivery rolls. The delivery of roving from the rolls, the rotation of the spindles, and the drawing out of the carriage are started at the same instant. While the roving is being delivered, the speed of the carriage is about the same as the surface speed of the delivery rolls. When the rolls stop, the carriage continues to draw the yarn, till it reaches its limit of as the spindle revolves, and each revolution of the spindle puts one turn of twist in the yarn. To watch the operation of a mule while spinning is extremely interesting, and would almost convince one that it was possessed of an intelligence of its own. The motion of the carriage in either direction, the delivery of a determined length of roving, acceleration of spindle speed during the drawing and twisting, the easing off to allow for the contraction of the yarn due to the twist and the perfect formation of the bobbin from bottom to top seem well nigh impossible for inanimate matter to accomplish.

When the bobbins are full, they must be removed and the spindles re-

filled with empty ones. This is accomplished without disturbing the operation is completed, the fallers locked down, and a few turns of yarn



Four-Section Mule.

yarn. The mule is stopped just as it is about to back off after the twisting taken about the spindle below the bobbin, which fastens it securely, then

the full bobbins may be removed. The objects to be obtained by spinning are not, as many suppose, simply the twisting of the yarn and placing it on bobbins. In addition to these very important features, the drawing of the yarn plays an essential part in the production of a sound, perfect thread. In common with nearly every process in textile manufacturing, the success of the spinning depends to a marked degree on the thoroughness with which the previous operations have been performed. While it is undeniably true that an expert spinner can do much toward rectifying mistakes that have been made in the card room, it is, nevertheless, impossible for him to attain the highest possible success, if the materials with which he has to deal are not in the best possible condition when he receives them

It is utterly impossible for the most expert spinner to make a perfect, even thread from uneven, twitty roving. By skillful adjustment of the various parts of the mule, he may be able to overcome in part some of the defects due to lack of care in the carding.

IMPORTANCE OF DRAWING.

It is a matter of some surprise that so many spinners have so slight a realization of the extremely important part that the drawing has in the production of perfect yarn. In the description of woolen carding it will be remembered that the fancy was the last roll to act on the stock before it left the finisher card to go to the ring doffers and condensers. The statement was made that the fancy simply acts as a brush, raising the stock to the points of the teeth of the cylinder clothing so that it may be the more easily removed by the doffers. This brushing action of the fancy, together with the slower surface speed of the doffers, has a marked tendency to disarrange the parallelization of the fibres effected by the carding. The

DRAWING OPERATION

during the process of spinning corrects this to a certain extent, and draws the fibres into a more nearly parallel condition again. Very frequently it will be found that complaints of tender yarn in the weave room can be entirely eliminated by a change in the drafting on the mules. It is manifestly impossible to bring out the greatest strength one is able to secure with the stock used unless the fibres are drawn to such an extent as to insure their interlacing with as many others over as great a space as is possible. Drawing the yarn while twisting also tends to even up the inequalities of the roving somewhat, the twist setting in the finer spots as the yarn is being drawn, leaving the thicker untwisted portions to be drawn out and reduced to more nearly the correct size.

The production per spindle is dependent to a very great extent upon the size of the yarn and the quality of the stock. The usual equipment in modern mills is to allow a 360-spindle mule for a set of 48-inch cards. The number of mule spindles required to put the production of a set of cards into yarn, however, is a variable quantity, depending on several features. The class of stock, the size of the yarn, and the amount of draft required, all have a very material effect on this question. The latter is an item that does not receive the attention that it demands at all times. On good stock it is customary to make the roving double the weight of the yarn to be spun, that is, to produce a four-run yarn the roving would be made two-run on the cards. If in the judgment of the spinner, the stock will permit, it would be well to make the roving still heavier, making a material increase in the card room production without in any way affecting the quality or running of the yarn on the mules. On coarse yarns the manufacture of which presumably entails the use of a cheaper and inferior stock, it may be necessary to make the roving relatively finer, that is, ⅞ run or possibly 1 run to produce a 1½ run yarn. It is impossible to formulate a rule that will give the best results at all times, and details of this kind must be left for the carder and spinner to deal with as the exigencies of the case demand.

Worsted Yarn Manufacture

The first operation in the manufacture of worsted yarns, except in the case of a few varieties of extremely long wools, is somewhat similar to the first process used for woolen yarn making. Instead of the set of cards, consisting of three separate machines, the worsted card is a single machine with two or three cylinders mounted on the same frame, with workers and strippers similar in appearance and functions to those on the woolen card described in a former article. The object of carding is to comb the wool and lay the fibres as straight and as nearly parallel as possible, making a sliver in which every fibre retains its length. A very important item is that the

WEIGHT OF THE SLIVER

be maintained as uniform as possible from day to day, otherwise it will be impossible for the comber to make the comb slivers of uniform weight.

A marked difference between woolen and worsted carding is in the method of removing the carded wool from the machine. In the worsted card the stock is taken from the doffer in the form of a flat web by a vibratory comb, and delivered through a tube to the balling head, without a change in its direction of motion through the card. This tends to preserve the parallelization of the fibres affected by the carding operation. The balls of "slubbing" are then placed on the preparing gill boxes where a further combing takes place. The essential features of the gill box are the front and back rolls and a set of fallers as shown in Figure 1. The action of the machine is governed entirely by the

RELATIVE SPEEDS

of these three parts. The motion of the rolls is rotary, that of the fallers horizontal, all three moving the wool forward in the same direction. The combing action of the gill box is due to the fact that back rolls, fallers and front rolls all move at different speeds. Reference to Fig. 1 will make the explanation of the operation more clear. We will assume that the back rolls A are delivering a sliver to the fallers B, which are steel bars containing two rows of pins. While the back rolls are delivering one inch the fallers may travel one and a half inches, and in the same time the front rolls C deliver six

Fig. 1. End View of Gill Box—A Back Rolls; B, Fallers; C, Front Rolls.

inches. The arrow indicates the direction of motion of the fallers, which are carried by a screw. When in the position indicated by 1 the faller drops to a second screw which carries it back directly under that marked 2, and is raised into position as No. 2 travels forward. From this gill box the slubbing may be taken to the back washer to remove the impurities from the wool. This is accomplished by passing the sliver through two bowls, each of which have a pair of squeeze rolls to press out the suds after treatment. From the last pair of rolls the sliver passes over a series of heated cylinders which dry it thoroughly before it reaches the gill box attached to the front of the back washing machine. In many spinning mills it is customary to apply oil just previous to gilling on the back washer, while in others this is done during the next gilling operation, from which the sliver goes to the "punch box," a machine that rolls four ends of sliver into a ball ready for combing.

WORSTED COMBING.

The type of comb most commonly used in our domestic mills is the Noble or great circle comb, of which Figure 2 is an illustration. This is used for combing all classes of wools,

though the Lister or nip comb is probably adapted for extremely long stocks. Though the general design and principle of the Noble comb have not been changed in over 25 years, it has been materially improved mechanically. The first and more important of these improvements was the invention of a greatly accelerated dabbing brush, increasing the production about 20 per cent; the second, and comparatively recent improvement, was the application of ball bearings to the carriage, which has reduced the power consumption to a marked degree.

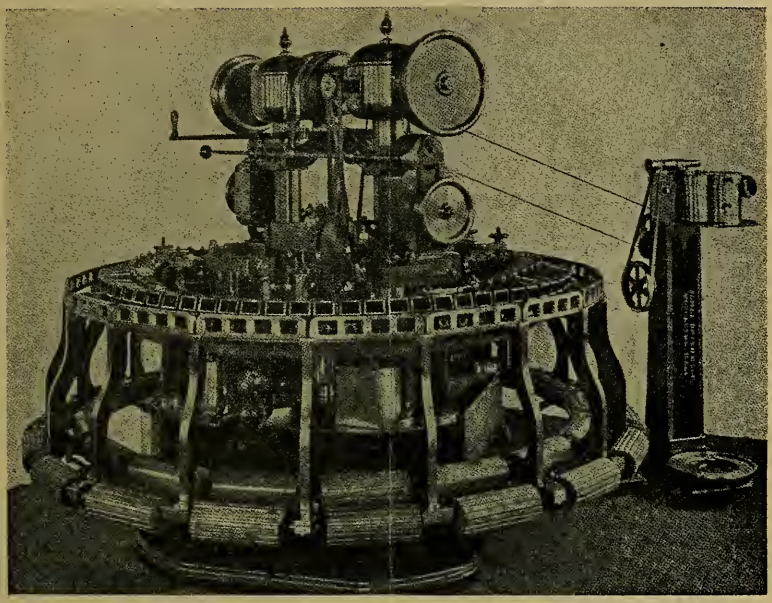


Fig. 2. Improved Noble Comb.

The principal features of the comb are the large horizontal circle with its five rows of vertical pins, two small horizontal circles with rows of upright pins, the outer row of which touch the inner row of pins on the large circle, the two dabbing brushes, which drive the wool down into the

PINS OF THE TWO CIRCLES

at this point of contact, and the vertical drawing-off rolls, which take away the sliver of long fibres. The success of the machine is due to its simplicity, depending on the comb circles alone to clear the wool and remove the noil, as the short, curly fibres are termed. Another point of difference from all other combs is that the wool in process of combing is carried in a creel attached to the revolving circle. The punch box measures the length of sliver wound into the four end balls, as it is essential that each ball should contain the same length. The creel holds 18 balls, a total of 72 slivers being combed at the same time, which insures very thorough mixing. The perimeter speed of the large and small circles is the same, so that at the point of contact they are practically stationary in regard to each other, which permits of the wool being pushed down into both circles simultaneously. The combing results from the fact that as the circles rotate they draw apart, so that the wool, which was forced into

the pins of the circles when they were close together, is combed as the distance between the circles increases.

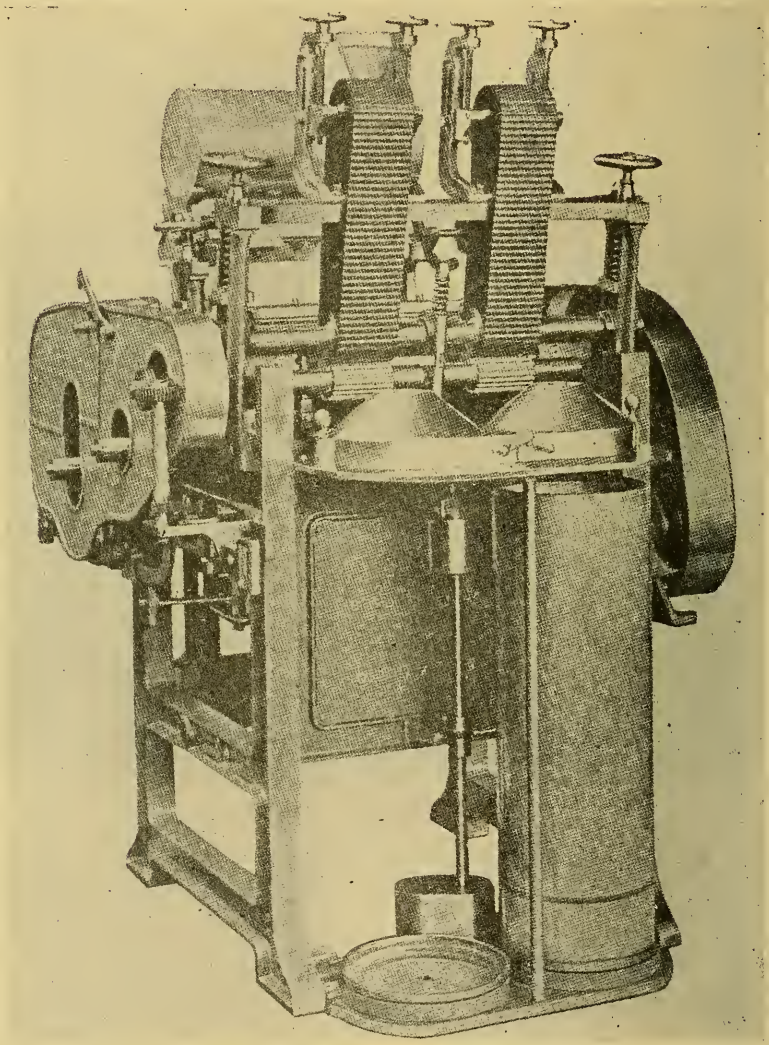


Fig. 3. Double Can Gill Box.

The efficiency of the comb depends on the separation of the circles, as all the short wool, nibs and shive, are forced into the pins by the dabbing brush. As in fine circles there is less than 1-100 of an inch between the pins it is obvious that no nibs or vegetable matter can pass through these fine

spaces, so that the fringe of wool hanging from the circles is free from all matter of this nature. As the circles travel the fringes of long wool are engaged by the drawing-off rolls and removed in the form of a continuous sliver of long fibres, leaving the short wool, burs and nibs within the rows of pins. This mixture, termed noil, is removed by a set of stationary knives, and falls into a funnel which conducts it under the comb. The combed sliver, called top, is carried to the back of the machine and coiled into a can. To prepare the sliver for the drawing and spinning requires the use of two gill boxes. The objects to be obtained are fourfold: 1. The blending of the various lengths of fibres. 2. To further parallelize them. 3. The application of water in order to properly condition the top so as to insure every yard of sliver weighing the same. 4. Winding the sliver into balls for economy of space and to facilitate handling in the drawing room.

In order to obtain a sliver that shall be as nearly perfect as possible, it is essential that the various lengths of fibre should be mixed thoroughly through every portion. The sliver from the Noble comb is made up of four small slivers from the four sets of drawing-off rolls. The wool from the large circle is longer than that drawn from the small one, necessitating the gilling operation to equalize the length of the fibres in all parts of the silver. (See Figure 3.) The chief point of difference in the two finishing gill boxes is that the first delivers into a can, while the second winds the finished top into a ball. It must not be understood that a single sliver is delivered to a gill box for treatment. At the first box, 28 cans of comber sliver are placed in position, and the ends fed to the back rolls. Assuming that the comber sliver weighs an ounce per 10 yards, and the box has a draft of five,

THE RESULTING SLIVER

will weigh 5.6 ounces per 10 yards. Four of these slivers may be fed to the second box, which, with a draft of five, will give a finished sliver weighing practically 4½ ounces per 10 yards. In order to make yarn of uniform weight, it is essential that the tops go to the drawing room of uniform weight and with a standard amount of oil and water, or as it is usually termed "condition." The sliver is now in the condition known as finished tops and ready for the next series of processes termed drawing.

WORSTED DRAWING.

Many of our smaller worsted spinning mills buy their raw material in the form of finished tops, confining their operations to the drawing and spinning. The process of drawing continues the operation of parallelizing the fibres and reduces the slivers to roving suitable for the spinning frames. This is accomplished on a series of machines technically termed a set of drawing. There are three systems in common use: open drawing, cone drawing and French drawing. The first two are variations of the Bradford system, the first of which will be described here. The principle of drawing is simple in the extreme, consisting of reducing a large sliver, or number of slivers, down to a roving small enough to be spun without excessive draft, at the same time to so even the sliver that the spun thread will be of a uniform size. This can be done in no other way than by a pair of back rolls revolving slowly, drawing the sliver in, and feeding it in turn to a pair of front rolls revolving rapidly and drawing the wool out. By a repetition of this process and a sufficient number of doublings, a roving of the correct weight and condition is produced.

A set of drawings for yarns to be spun to 40s or thereabouts consists of about eight operations and requires the following machines:

First	operation 2	double head can gill boxes.
Second	operation 2	two-spindle gill boxes.
Third	operation 1	four-spindle draw box.
Fourth	operation 1	six-spindle weigh box.
Fifth	operation 1	eight-spindle draw box.
Sixth	operation 2	twenty-four spindle finishers.
Seventh	operation 3	thirty-spindle reducers.
Eighth	operation 9	thirty-spindle rovers.

The doublings and reductions for a 1,282 dram top (40 yard weighing) to

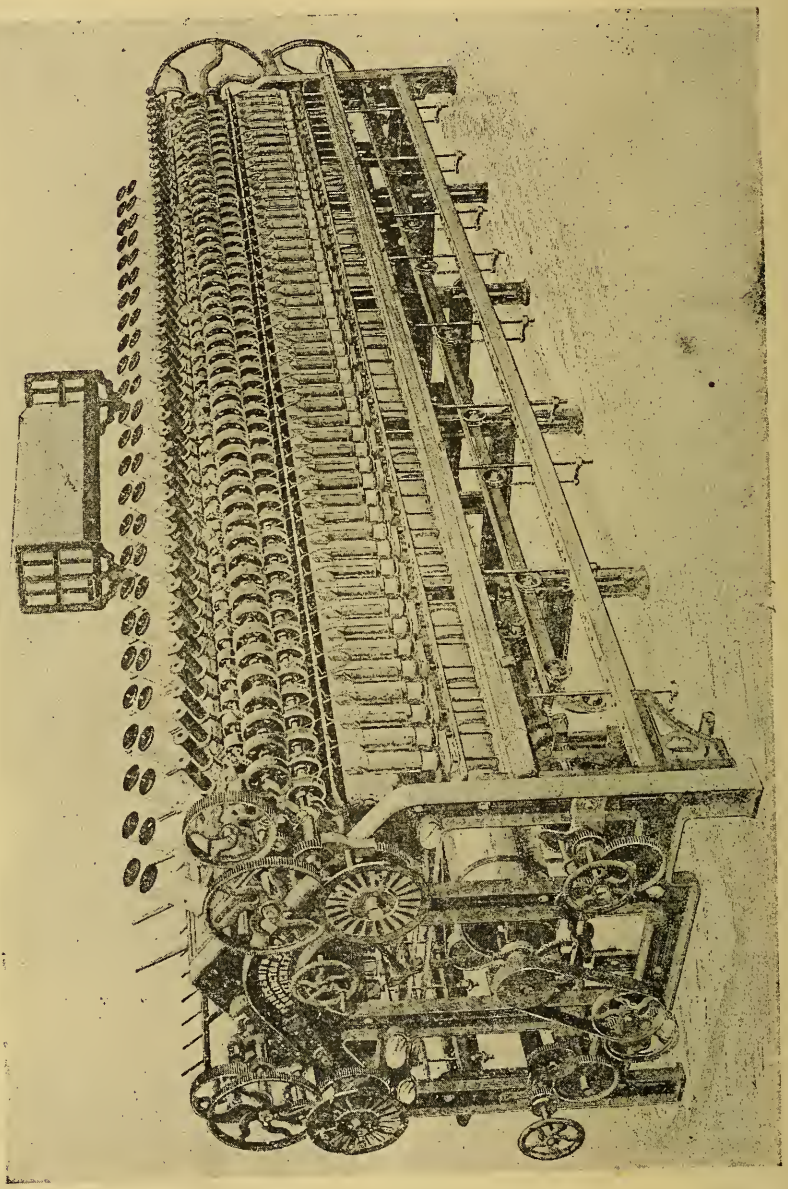


Fig. 4. Cap Spinning Frame.

produce a 4 dram roving would be as follows: Five slivers at the first gill box, with a draft of seven, will give a sliver weighing 916 drams. Five of these at the two spindle gill box, with a draft of seven, will give a sliver weighing 654 drams. Five of these in the four spindle draw box, with a draft of seven, will give a sliver weighing 467 drams. Four of these, with a draft of seven in the six spindle weigh box, will result in a sliver weighing 267 drams. In the next operation, three slivers are put up at the back of the eight spindle draw box. With a draft of seven the sliver produced will weigh 114½ drams. Three of these slivers in the finisher, with a draft of seven, will give a sliver weighing but 49 drams. Two 49 dram slivers at the reducer will produce a 14 dram sliver with a draft of seven. For the final operation in the drawing, two of these slivers are placed on the rovers, and with a draft of seven, produce the desired roving, weighing 4 drams. The rovings from this frame are taken to the spinning room ready for the final processes of yarn making.

WORSTED SPINNING.

Of the four methods of worsted spinning in common use, the cap frame is, perhaps, the most used and is the one here shown in Figure 4. The spinning process, as stated in the article on woolen yarn making, consists of three operations, drafting, twisting and winding the yarn on bobbins. These are all accomplished on the same machine, and on the cap frame are continuous.

The cap frame is particularly well adapted for the production of fine counts of yarns, and is capable of a much greater production than other types of spinning frames, as the spindle speed may be much greater than would be possible on the other systems. The disadvantage of this method of spinning is that the high spindle speed (6,000 to 8,000 evolutions per minute) with nothing to protect the yarn in its rapid travel around the cap, creates a considerable friction with the air, producing a somewhat rougher thread which raises the fibres on the yarn, than a flyer or ring frame. The enormously greater production, however, overcomes this objection in a great

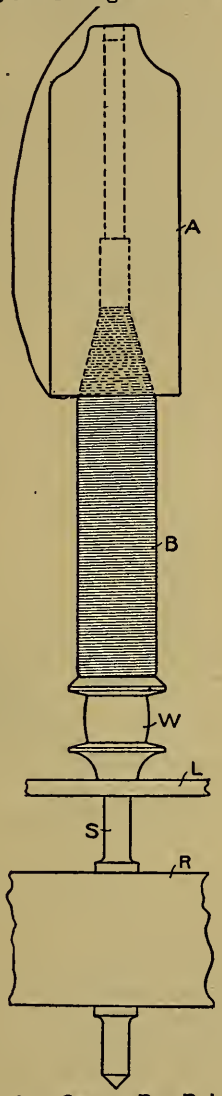


Fig. 5. A, Cap; B, Bobbin; W, Whorl; L, Lifter Plate; S, Spindle; R, Spindle Rail.

measure, as also does the fact that the defect is not nearly as noticeable on fine yarns. The method of operation will be readily understood by referring to Figures 5 and 6. The line drawing, Figure 5, shows a bobbin partially filled. A is the cap, fixed at the top to the spindle. B is the bobbin on a tube or sleeve integral with the whirl W, which is raised and lowered by the lifter plate L. R is the spindle rail, into which the spindle S is firmly screwed. The drafting is accomplished by means of back and front rollers similar to the method employed in the drawing. An end elevation of the roving and drawing

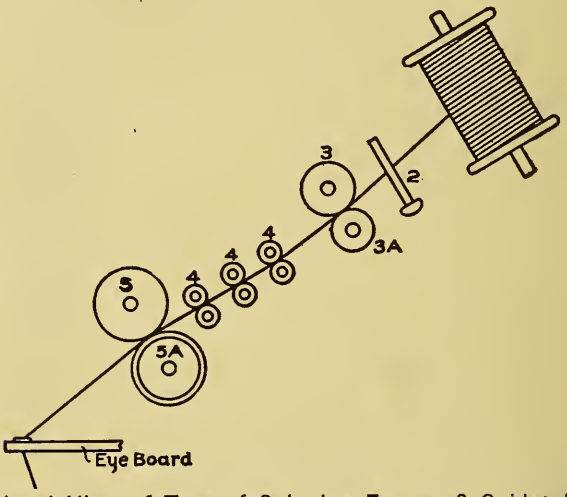


Fig. 6. Sectional View of Tops of Spinning Frame—2 Guide; 3, 3A, Back Rolls; 4, Carrier Rolls; 5, 5A, Front Rolls.

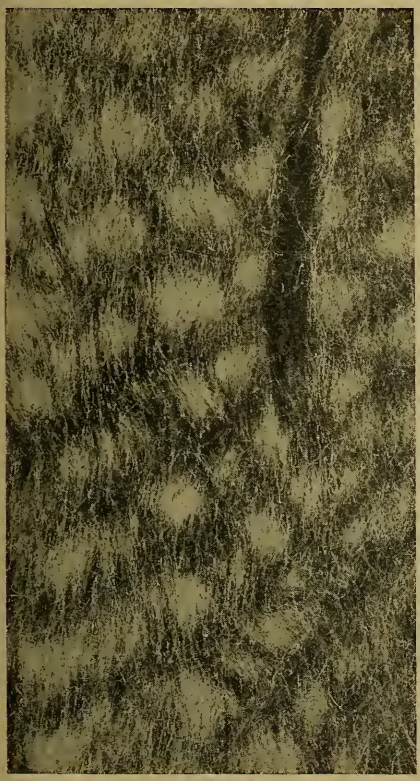
rolls is here given. The spools of roving are placed on the upper part of the frame on suitable spindles, the roving passing through the guide 2 between the back rolls 3, 3A and the carrier rolls 4 to the front rolls 5 and 5A, which revolve faster than the back rolls, thus reducing the roving, which is then twisted and wound on the bobbing. The back rolls are metal, the carriers usually of wood; the bottom front roll is metal and the top roll metal with a covering of leather. The wearing of this leather in spots is a frequent source of imperfection in the yarns, and requires the recovering of the rolls. The top rolls in the drawing and spinning rooms should be

FREQUENTLY INSPECTED

by those in charge of the departments, and defective rolls replaced with those in perfect condition, so that the labor of removing defects in yarn and cloth may be minimized. Yarns to be used for warp are usually two plied, that is two threads from the spinning frame are placed on the twisting machine and given a varied number of turns per inch, depending on the size of the yarn and the use to which it is to be put. Filling yarns are very frequently used directly from the spinning bobbin.

Vigoureux Printing

Though comparatively new in the United States, the vigoureux system of printing tops is by no means a new process, having been invented by M. Vigoureux of Rheims. The process consists of printing the slivers with



Printed Sliver.

bands of color by means of fluted rollers, which are interchangeable, producing various percentages of colored and white sliver as desired. The cut shows a portion of the sliver as it comes from a printing gill which was fitted with double spiral fluted rolls, forming a cross hatch pattern.

It is not customary to use more than one color, as it has been proven extremely unsatisfactory to make fancy mixtures in this way. If it is desired to have several colors in the mix it has been found

LESS EXPENSIVE

to print the various colors on separate slivers and blend them in the gill boxes. For some years it was considered that yarns made by the vigoureux system were not suitable for men's wear purposes, but of late the process has been so improved that the results will permit of their being used in practically any fabric. The great superiority of this method of producing mixture yarns over that of mixing slivers of different colors in the gilling is the greater evenness of the resulting thread. The blotchy appearance of the goods, so often seen in ordinary mixtures, is entirely eliminated, for instead of every fibre being entirely of one color each has its proportionate share of color, and the blend is much more homogeneous than can possibly be obtained by any other method. The installation here described is capable of producing 1,500 pounds daily, and consists of two printing gills, steam box, back washer and an intersecting gill box for unfelting. The

FIRST OPERATION

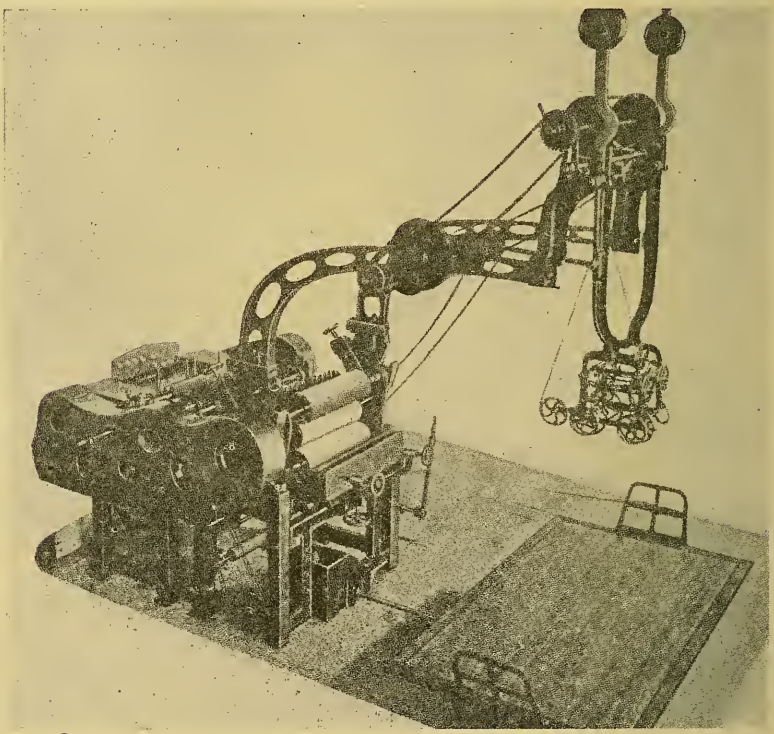
in vigoureux dyeing consists of passing the sliver through the gill box and printing machine. The tops are placed in a creel for a doubling of 16 ends per head. The gill box has a single head of wide pitch, the pitch being 890 millimeters and the set-over 500 millimeters. The gill box is of the ordinary type of construction. The draft of the gill box is from 4 to 6, the slivers leaving the front rolls in a wide sheet, which runs under the printing rollers.

The coloring matter is conveyed to the coloring roll by a rubber roll, par-

tially immersed in the dyebath, which is contained in a wooden trough. The coloring roll is of rubber, covered with felt. The machines are fitted to operate with either one or two printing rollers on the same coloring roller. The printing rollers have

SPIRAL FLUTES,

one roller having the spiral to the right, the other to the left, so that, with the rollers working in conjunction, the wool is marked in a diamond shape. The mark may be made by



Printing Gill Box, Skene & Devallee.

close or open mesh, according to the pitch of the flutes of the printing rollers.

The shade of the resulting mixture is governed entirely by the closeness of mesh of the printed pattern. To obtain various depths of shade it is necessary to have an assortment of rolls with different flutings. By the use of two pairs of rolls, one coarse and one fine, it is possible to obtain a wide variation of shades. They may be used singly or in several combinations, the two fine rollers together, a single roll, either coarse or fine, or one of each kind together. The printed sheet of wool on leaving the rollers is conducted over a series of

REVOLVING CAGES,

in order to allow the dye to soak in and dry somewhat before being deposited on the sheet. The use of linen sheets for receiving the wool from the printing machine is recommended, as they are best adapted for the steaming operation which follows.

The printed tops, tied up in the

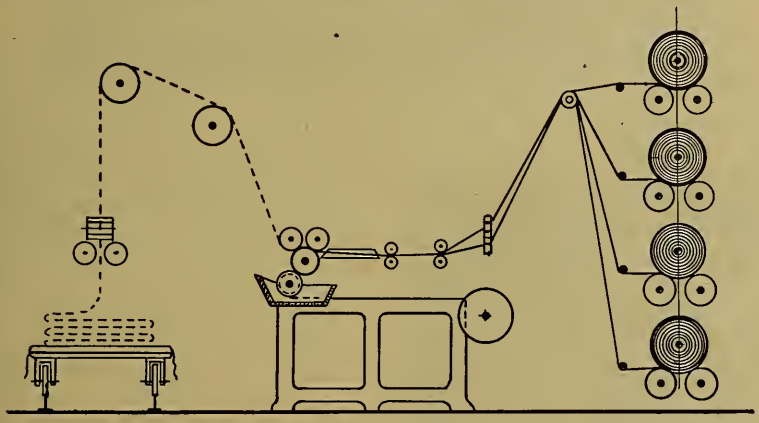
linen sheets, are placed in the steam box as tightly as possible, in order that the steam may not escape freely but penetrate the stock thoroughly. The use of a wooden steam box is advised, rather than one constructed of metal for obvious reasons. High pressure in a metal receptacle is likely to do serious injury to the stock. The length of time necessary for the steaming operation varies with the dyes used and the quality of the wool. In some cases, after an hour's steaming at low pressure, the stock is removed, cooled off and again subjected to the steaming. When cooled off the stock is placed on a scray under the creel of the back washer. This is preferably of special construction, having five bowls, instead of the two found in the ordinary machine. The doublings are eight to twelve, according to stock under treatment. After passing through the five bowls, for the removal of surplus dye, the sliver is dried by passing over a series of steam-heated cylinders, and goes direct to the double head gill box of two spools each, which is built integral with the back washer. The final operation, or, as it might be considered, the first in the drawing, is the passage of the washed and dried slivers through the intersecting gill box. This is of the type known as the

INTERSECTING GILL BOX

for heavy doubling and heavy draft. The doublings here are 10 per head, with a draft of 10. The peculiar feature of this machine is that it has, instead of a single set of fallers with the pins pointing up, an extra set for a part of the distance, with the pins pointing down and intersecting with the teeth in the bottom set. The drawing of the sliver in a gill box of this type completely removes any tendency toward felting, resulting from the preceding processes.

In printing tops it is necessary to use a gum of some sort in the dye-bath, and one that is readily soluble in warm water. Those in most common use are British gum and tragacanth, a domestic product, D. & M. (Danker & Marston) is also used with very satisfactory results. The dyes used for this system are of many kinds, the dyer having a wide range of drugs to choose from.

Some of the colors used with excellent results are: Mordant yellow G, GS, R and 3D, alizarine red S powder, the various palatine chrome browns and scarlets, the oxamine colors and the anthracene blues. A few



Sectional View of Printing Gill.

formulas that have worked very successfully in mill practice are as follows:

8%	Alizarine Black S. R. powder.
19%	Water.
50%	British gum.
5%	Acetic acid 9 degrees Tw.
3%	Oxalic acid dissolved in
5%	Water.
10%	Acetate of chrome, 32 degrees Tw.
100%	

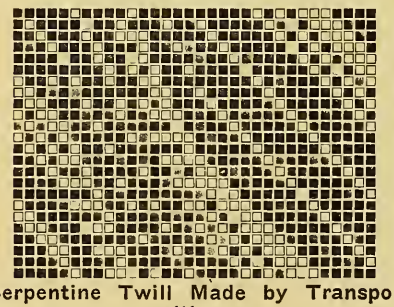
5%	Palatine chrome blue R, dissolved in
3%	Glycerine,
25½%	Hot water and
50%	British gum thickening;
	When cool, add
3%	Oxalate of ammonia,
½%	Chlorate of soda,
12%	Acetate of chrome S. 32 degrees Tw.
1%	Turpentine oil.
100%	

5%	Palatine chrome brown R, dissolved in
3%	Glycerine,
25½%	Hot water and
50%	British gum thickening;
	When cool, add
3%	Oxalate of ammonia,
½%	Chlorate of soda,
12%	Acetate of chrome S. 32 degrees Tw.
1%	Turpentine oil.
100%	

5%	Palatine chrome claret dissolved in
3%	Glycerine,
25½%	Hot water and
50%	British gum thickening;
	When cool, add
3%	Oxalate of ammonia,
½%	Chlorate of soda,
12%	Acetate of chrome S. 32 degrees Tw.
1%	Turpentine oil.
100%	

Angles of Twills

The ordinary method of constructing serpentine twills is to combine a series of twills whose inclination from the horizontal gives the desired effect. The method of forming such twills is very simple and consists of



Serpentine Twill Made by Transposition.

using the regular twill as a base, then taking every other perpendicular line in the draft, every third line, and proceeding in this manner, then reversing the procedure until the original twill is again produced as in the example shown. To form a reclining twill proceed in the same manner with the

HORIZONTAL LINES.

A similar effect may be produced by a change of texture in the warp as exemplified in the bouclé pattern so popular some time ago. A cut of the fabric is here shown and will convey to the mind of the reader the effect produced in a clearer manner than a written description. The warp used for the fabric illustrated was dressed 20 ends of four run and 20 ends of 2 run alternately, the four run reeded 4 per dent and the 2 run 2 per dent, giving a fabric of even weight throughout, but with a vastly different texture in alternate stripes. In the stripe made by the coarse warp yarn the twill is practically 45 degrees but in the fine stripe becomes a 63-degree twill with the same chain and the identical filling texture, the change in angle of the twill being caused entirely by the difference in warp texture. It is supposed by many that the ordinary type of twill chain will produce a 45-degree twill on the woven goods under all circumstances, as exemplified by the following query, but the facts in the case are as stated in the answer thereto.

ED. AMERICAN WOOL & COTTON REPORTER:

We are enclosing a small sample of a four-harness twill that we figure is woven two up and two down. You will notice, however, that the twill is about 57 degrees, while a regular four-har-

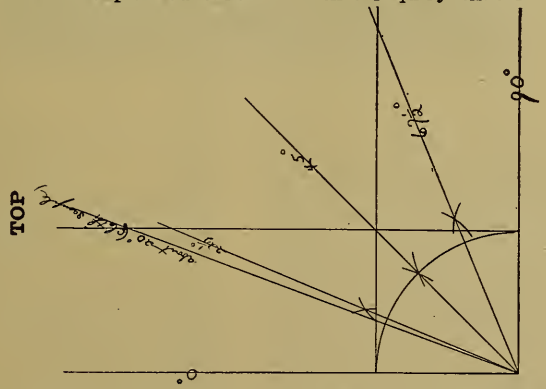
ness twill is 45 degrees. How in your opinion is this 27-degree twill obtained? Do you think it is done in finishing by the tentering machine? Yours truly,
No. 2491.

There is a very great difference between the angle at which a weave runs in a design and the angle at which any certain weave runs when it is woven into cloth. This subject has never been treated at all clearly in any of the technical books upon the subject and should be explained carefully in order to make results entirely clear. Usually design books give certain weaves or changes of weaves which are known as certain degree twills. and this is entirely correct for the weave upon ordinary design paper or upon cloth which contains exactly the same number of threads and also of picks per inch. Whenever the construction varies from the same number of threads and picks per inch

THE ANGLE OF THE TWILL

in the woven cloth will vary from that originally noted. That is, it will no longer be at the angle which the weave would indicate when it is on the design paper. The idea expressed in this inquiry that it is done in finishing by the tentering machine is incorrect, and while finishing does affect the angle in the cloth to a slight amount, it has nothing whatever to do with the radical changes in angle

Serpentine Twill Made by Variation of Warp Texture.



noted in the cloth.

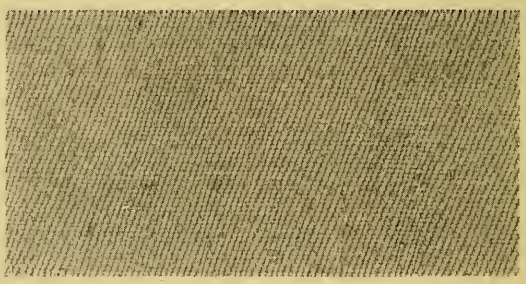
There is used in this cloth a four-harness twill, which is usually described as a 45-degree twill, and it is a 45-degree twill upon a weave standard, or even in cloth when the same number of threads and picks per inch are noted. We give herewith a small sketch which will explain clearly the reason why the angle of the twill in the cloth is not the angle in the design. This cloth contains about 44 picks and about 122 threads per inch. These figures may vary slightly in other portions of the cloth, but the figures given are approximately correct. It will thus be noted that the ratio between the warp and the filling is 2.78. That is, in the cloth for a certain space there will be 2.78 times as many threads as there are picks.

BY EXAMINING THE SKETCH

the result obtained should be clear. In the small square, which we have made off on a horizontal line the ratio which the warp is to the filling and then by drawing a line through the point obtained the angle of the twill can be closely approximated. You will note that it is not 27 degrees, but rather that it is about 20 degrees

IN THE SAMPLE SUBMITTED.

If the number of picks per inch be increased more than there are threads per inch, the angle of the twill will become more nearly horizontal, and this angle can be obtained in a similar manner to what we have used in the illustration. The various degrees are marked to make the situation clear. Some manufacturers designate the angle of twills similar to what we have used on the illustration submitted, while others use an opposite method. That is, they call the horizontal line 0 degrees and the vertical line 90 degrees, thus making a twill such as you have submitted about a



27-Degree Twill.

about two inches each way, this weave would make the 45-degree twill that we have drawn if there were 122 threads and also 122 picks per inch, or in fact if any number of threads and a like number of picks were used in the cloth. Now consider what happens in the cloth submitted. For every 122 warp threads it will require 2.78 times as much space for the same number of picks. In other words the 45-degree weave does not remain any longer at an angle of 45 degrees, but is forced much nearer a vertical position. The angle of any weave in a fabric can be obtained very easily by the method which we illustrate. Mark 70-degree twill instead of a 20-degree twill.

Do not confuse the degree of a weave and the degree of a twill or weave after it is woven.

THE CLOTH CONSTRUCTION

always has an influence on the weave, and every change in construction will produce a different result. A few experiments upon the loom will show this more clearly. First place upon the loom a pick gear which will give 40 picks, then one which will give 80 picks, then another which will give 120 picks, all with the same degree of weave or twill used. The de-

gree of the woven twills will all vary according to the degree of weave used and the construction of the cloth being made.

Textile Cost Finding.

Cloth is sold to the consumer at prices that seldom represent actual intrinsic value, the prices being determined in a measure according to the popularity of the fabric. Nevertheless, the actual cost to make any particular fabric is the basis on which the manufacturer is paid for the work performed and the stock used in its construction.

The value of labor in making a cloth is pretty well standardized, and the value of the stock is closely reported in the market, so that with this information, in combination with a reasonable allowance as profit on investment, the value of a given fabric may be easily ascertained without severe technical training. It should be clearly understood that when speaking of cloth the author does not include knit goods, only the production of the loom.

All cloth has a warp and a filling. The warp threads are those which run lengthwise in the cloth, and filling threads are those crossing the warp threads from side to side of the cloth. A perfectly balanced cloth contains the same number of threads of warp and filling to the square inch, of yarns of the same thickness, and on examining such a cloth, it will be found that each warp and filling thread passes over and under each other alternately.

As each thread occupies a definite space, the number of threads to the inch will be according to the thickness of the yarn, and as yarns are spun to a positive thickness, which is designated by a number, this number indicating the actual length of yarn per pound, the cloth will contain threads according to the number or thickness of the yarn.

The yarns that go into the warp or filling are spun from stock capable of being spun the fineness required, and the manufacturer judiciously selects his stock with not alone the fineness of yarns to be spun in his mind, but also the intrinsic value of available and suitable stock.

STOCK USED

in making cloth is divided into animal and vegetable fibres of various kinds, classes and grades. Value of stock is determined within its class according to its spinning possibilities, the finer it will spin the more valuable it is. The relative value of classes of stock is otherwise determined; for instance, a pound of fine cotton can be bought around 20 cents, whereas a corresponding fine grade of wool could not be obtained at less than 80 cents, and yet the above cotton can spin 84,000 yards per pound, while the above fine grade of wool could not spin more than 33,600 yards per pound. In speaking of standards of value, it is, therefore, necessary to keep in mind that cloth made out of cotton and cloth made out of wool are calculated from different basic values.

The features to be considered in estimating the value of a fabric are: The stock used, the cost of converting the stock into yarn, the weaving into cloth, the finish which the cloth receives, the expense of putting it on the market and manufacturing profits.

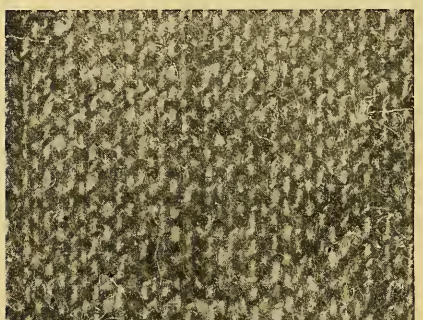
The first factor, stock used, varies as to first cost by the world's laws of supply and demand, and the only way to properly handle stock is by watching the variation in values of stock in the markets. The cost of converting stock into yarn is pretty well standardized, so much so that the market variation for yarns is produced primarily by the variation of the price of stock used.

The cost of weaving is determined

by various factors: First, the speed of the loom the fabric may be woven at; second, the number of looms one weaver can run, and third, the average wages for which weavers may be employed. These different features are now well standardized, and rules of value established. Finishing includes dyeing, and it also is well standardized in its cost for material and labor in the process.

Recognizing these standards established, as evidenced by the uniformity of prices that yarns, for instance, can be bought anywhere, we have now to consider the value of a fabric in its construction.

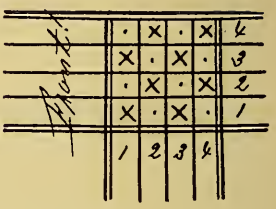
The written language of textile design is expressed on what is called point paper. This paper is lined off in small squares, the number of squares used representing the number of threads in a pattern of the design. All warp threads which are woven on the face of the cloth are expressed by an X, and the filling



Medium 15 to 16 Ounce Crash.

threads which are woven on the face of the cloth by an empty square. (These rules are not absolute, but the exceptions will be mentioned later.)

By referring to the accompanying illustration of a fabric taken from our Woolen Glossary, an understanding may be obtained of the written language of textile design.



Design.

SECOND GRADE OF CRASH.

Made of medium grade of wool, 15 to 16 ounce finished.

1,080 ends, 18 picks; reed 8—2—67½ inches between the list; 6/4 finished.

Warp: 1,080 ends, 1½ run	7	20/100 oz.
Filling: 18 picks, 1½ run	8	34/100 oz.
	15	55/100 oz.
10% shrinkage	1	55/100 oz.
Equal loom weight	17.1	oz.

COST CALCULATION.

Med. wool: 49c. lb. or 2½c. oz.		
Material: 17.1 oz. + 10% shrinkage	=	18.8 oz.
18.8 oz. @ 2½c	=	47c.
Manufacturing: 18 picks	=	20.3c.
Mill cost		67.3c.

Woven on 4-harness straight draw.

The second sample of cloth in our Woolen and Worsted Glossary is a well-balanced cloth of twenty threads of warp and twenty threads of filling in one inch of the finished fabric. The designer's point paper shows, reading from the lower left hand corner, that the first warp thread is on the face once and on the back once, and so on in this order, while the second thread is on back once and then on face once, reversing the order of weave. This makes both warp and filling threads fit together firmly in the cloth, but if the yarn was not of sufficient thickness in either warp or filling, the cloth would not feel firm.

By referring to

THE LAYOUT,

it will be found that the designer has described the kind of stock wanted (medium grade of wool) and the number of ends or threads (1,080) in the full width of warp and the number of picks or filling threads, 18, oc-

cupying one inch of cloth. To understand the calculations it is necessary to bear in mind what we have already stated—that yarns are known by their number, and that this number implies a given number of yards to the pound.

Further on in the above layout it will be noted in speaking of warp it specifies the yarn number as 1½ runs. This term means 1,600 yards of yarn to the pound, and when designated as 1½ runs, means 1½ times 1,600 yards, or 2,400 yards divided by 16 ounces gives 150 yards per ounce. Therefore, 1,080 yards divided by 150 warp yarn to the yard would weigh 7.2 ounces. In figuring for filling, the full width of 67½ inches has to be considered plus two inches for selvage or listing. Filling threads are usually designated picks and 67½ plus 2 equals 69½, multiplied by 18 picks will give the number of threads per yard (69½ times 18 equals 12,510). This divided by 1½ runs or 150 yards per ounce equals 8.34 ounces, which, added to the weight of warp, 7.2 ounces, equals 15.56 ounces. In weaving, the bend of each thread as it is woven in has to be considered, and experience has proven that with this cloth 10 per cent for take-up binder is allowed. Therefore, the weight is further increased to 17.1 ounces.

COST FIGURES.

In figuring cost, the price of stock used per pound should be reduced to the price per ounce to correspond with the yarn calculations in ounces. Medium wool is figured as being worth 40 cents per pound, divided by 16 equals 2.5 cents per ounce. At this point the percentage of loss in weight of stock all through the manufacturing of the fabric has to be figured, and in this fabric, it is set down at 10 per cent; therefore, it takes 18.8 ounces to make a yard of cloth weighing 15 to 16 ounces, and will cost 47 cents.

In figuring the cost of a woolen fabric in Bennett's Glossary, the manufacturing charges are based on the following table. This table was originated by a skilled and successful manufacturer. It is not only based on theoretical conditions, but is the outcome of a close scrutiny of all processes. Before adopted, it was subject to some severe tests, and since its adoption it has always proven a close and safe basis for estimating manufacturing charges.

Table of manufacturing costs for fancy cassimeres from raw stock, or fancy worsteds from grey yarn:

Picks.	Cost per yd.	Picks.	Cost per yd.
16	$ .196	44	$ .308
18	.203	46	.316
20	.21	48	.324
22	.218	50	.333
24	.226	52	.341
26	.234	54	.349
28	.242	56	.358
30	.25	58	.366
32	.259	60	.375
34	.267	62	.383
36	.275	64	.391
38	.283	66	.40
40	.291	68	.408
42	.30	70	.416

Cost per yard of piece-dyed worsteds and plain 2-loom work:

Picks.	Cost per yd.	Picks.	Cost per yd.
30	$ .20	46	$ .244
32	.206	48	.25
34	.212	50	.255
36	.218	52	.259
38	.224	54	.263
40	.229	56	.267
42	.234	58	.271
44	.239	60	.275

Cost of spinning worsted yarns from tops:

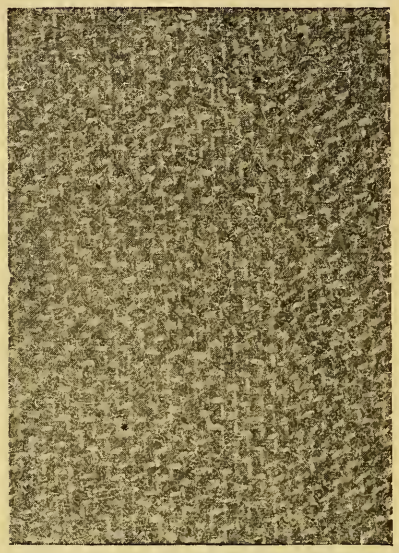
	Singie.	Two-ply.
1/15	$ .09	$ .13
1/16-1/19	.10	.14
1/20-1/23	.11	.15
1/24-1/27	.12	.16
1/28-1/31	.13	.18
1/32-1/35	.14	.20
1/36-1/40	.17	.22½

A table is found in the Glossary to determine labor cost. Eighteen picks will equal 20.3 cents labor cost, added to the cost of stock, which is 47 cents, equals 67.3 cents mill cost per yard.

We provide another illustration from the Glossary of Woolen and Worsted Fabrics by which an enlarged understanding of the designer's methods of recording his designs may be obtained. In addition to the fabric illustrated there are three other illustrations. The first is called a full draft, and gives a complete outline of the design in a manner fully explained above, the crosses showing the warp yarns as they appear on the face of the cloth. The second illustration shows it reduced to what is called the chain draft.

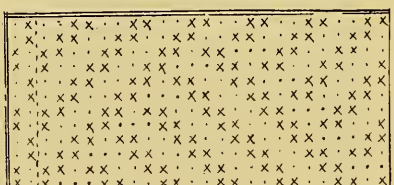
REDUCTION.

It will not be amiss at this point to explain the method



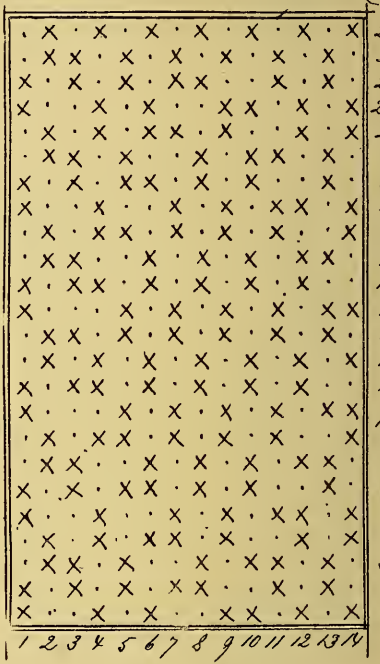
Medium-Weight Cassimere, 14½-oz.

pursued in reduction. In the first place, all squares running upward represent warp, and the cross-



Full Draft.

ings, filling. To reduce a full draft the designer begins at the first warp thread and gives it Number 1, and the following threads, when the arrangement of squares is the same, get the same number. In this case,



Chain Draft.

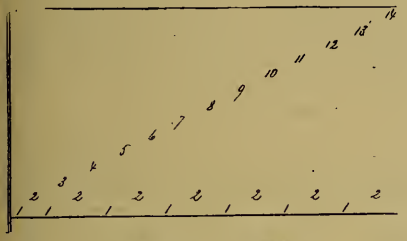
the second thread is different, as the crosses or risers are differently arranged, that is, the warp threads are appearing at different points from those of the first thread. This second thread is Number 2. The third thread is the same as the first, and is numbered 1. On reaching a thread of a different arrangement from those preceding, another new number is given, all repeats being marked by the number of the first thread so arranged.

THE CHAIN DRAFT.

When this is completed the repeats are all eliminated and this provides a chain draft as per third illustration, but the above work would not give

the desired results unless provisions were made to take care of the warp threads eliminated.

By referring to the fourth illustration, called the drawing-in draft, it will thus be found that the threads thrown out have been provided for, and that by drawing in repeat threads on the same harness each thread will rise



Drawing-in Draft.

and fall as per full design. This feature adds but little to the expense in manufacturing a piece of cloth, and but little consideration in costing.

The above explanation bearing on two of our woolen and worsted glossary fabrics is applicable to all the fabrics, as the same rule governs the cost in all cases, but in some instances additional features must be filling is added by a method of stitching.

FABRICS.

There are practically but four distinct classes of fabrics, namely: 1. Single fabrics in all their modification in interlacing.

2. Backed and double fabrics in which an addition is put on the back of the single fabric either by extra warp, extra filling; or a complete cloth, consisting of both warp and considered.

3. Gauze or open weave in which the threads of warp and filling are not in close weave together.

4. Pile fabrics in which loops or tufts are pulled up out of the ground fabric, producing what is known as warp piles or fabrics in which the weft to a filling is cut to form a pile, as in the case of velveteens.

Two particulars respecting the yarns of which fabrics are built should be considered, the length per pound of the yarn used and its diameter. As we have stated before, the length per pound determines a yarn's number, and there are three principal classes or series of numbers which are used to designate respectively woolen, worsted and cotton. The woolen series is based on 1,600 yards of yarn per pound to the number; therefore, a pound of one-run yarn will measure 1,600 yards, and all other runs are proportionate. For instance, five-run yarn will be five times 1,600, which equals 8,000 yards per pound. Instead of 1,600 yards, 560 yards is the worsted yardage per pound to the Number 1 worsted, and 840 yards to the Number 1 cotton, and all calculations for weight are based on these standards.

Diameters refer to the thickness of the yarn, and are determined by the threads that will rest side by side in one inch, and are obtained from the square root of the yards to the number, with a discount of 16 per cent for woolen, 14 per cent for coarse worsteds, 10 per cent for fine worsteds and 8 per cent for cotton yarns. Recognizing the factors that will determine the value of the fabric and the established standards governing these factors, the conditions under which a salesman may determine the value of a fabric are comparatively simple.

On making an analysis of a given fabric to ascertain its value, the first step is to take one or more square inches of cloth, more, if possible, and weigh on grain scales. Place this cloth in a high temperature to make it bone dry, weigh again and credit the variation to the presence of moisture. After keeping the cloth in a normal temperature long enough to receive normal moisture, take this fabric apart, one thread at a time, keeping the warp threads separate from the filling, and carefully count each thread, weigh the warp and the filling threads separately, making a note of the weight and the number of threads.

Assuming that the above cloth is one inch square, by multiplying the warp threads by the width in inches the yardage of warp yarn to a yard of cloth will be ascertained. The threads in the filling multiplied by the width will give the yards of filling yarn contained in a yard of cloth. By multiplying the width inches with the yard inches and the sum of the above by grains weight of warp and grains weight of filling the aggregate yards of warp yarn and of filling yarn contained in one yard of this cloth will be obtained and their weight in grains.

As an illustration, suppose the square inch of cloth weighed two grains of warp and two grains of filling, and that the cloth was 54 inches wide, the width multiplied by the yard inches, 54 by 36 inches, equals 1,944 square inches. This sum multiplied by two grains would equal 3,888 grains or 8.88 ounces per yard of cloth. And suppose there were 40 threads of warp per inch of cloth and 40 threads per inch of filling. The width, 54 inches, multiplied by 40 would give a total of 2,160 threads of warp and the equivalent in filling. By dividing the 2,160 threads of warp by weight in ounces, 8.88, would give 243, which is the yards per ounce, and this multiplied by 16 equals 3,888 yards per pound. Dividing this sum by the yarn number of either worsted, woolen or cotton denomination, the yarn count can be ascertained as follows: 3,888 divided by worsted count 560, number 6.94; 3,888 divided by cotton count, 840, number 4.62; 3,888 divided by woolen run, 1,600 yards, the size of the yarn in woolen runs would be 2.43.

On the basis of the above, the value of labor required to make the cloth may be ascertained, but the stock used has not been determined. Whether woolen, worsted or cotton, the wiry feel of cotton is easily distinguished from worsted and woolen goods, but the two latter classes are only different so far as the process of making the wool stock into yarn is concerned and the particular suitableness of stock wanted. For instance, worsted yarns can be made best from wool of long fibre, whereas woolen yarns are made from short wool.

DIFFICULTIES IN COST FINDING.

One of the most intricate problems in determining the cost of a woolen fabric is the question as to the stock used in its production. No system of cost finding, however elaborate it may be, will be of material assistance in this direction. The use of chemical tests and the microscope will assist somewhat, but even when used by an expert will not give

EXACT RESULTS.

The only means of arriving at a practical working basis is to examine the fabric, dissect it carefully, and from the appearance of the threads, with knowledge of the strength required to make work that will run well in the mill, the competent superintendent will be able to duplicate any cloth. The ability to do this cannot be gained from text books, but is the result of years of training in the various mill processes, and an intimate study of the various textile fibres. Only in this way can one hope to acquire the knowledge necessary to blend the stocks to the best advantage, and produce results that shall prove profitable to the mill. Estimating the cost of worsted cloth is much more simple, as the opportunities for manipulation are lacking. An examination of the yarns will readily enable one accustomed to handling them to determine the size and grade, and the price may be found in the columns of the American Wool and Cotton Reporter each week. The method used in determining the cloth costs will be readily understood by a perusal of the analyses of the various worsted fabrics contained in this glossary.

WOOLEN AND WORSTED CLOTHS.

The shorter and finer a wool is just so much easier and better it felts. This is an essential feature in finishing woolen goods, and woolen cloth in general is at its best when finished with a nap, and worsted with a close finish. Putting it in another way, fab-

rics that do not want to show a weave effect in the design are best made by the woolen system, but where a clearly defined weave is desired the design should be made of worsted yarns and cut close by the finishing shears.

The line of demarcation between woolen and worsted cloths is further accentuated in their weight. Woolen fabrics are at a disadvantage when they are made lighter than 12 ounces to a 54-inch width, but when over 16 ounces they are intrinsically better than worsted goods. On the other hand, worsted yarns made from wool of a proper length of fibre can be used in the making of the lightest and finest fabrics.

When woolen yarns are spun from carded stock the fibres are brought together at all angles, and although producing a lofty, soft-feeling thread, they do not attain the strength or finish of a worsted thread, whereas the process of spinning worsted produces a thread made of fibres all laying parallel, the short fibres being removed in the combing process. The preparing of stock, carding, combing, drawing and spinning of worsted yarns costs more than the process of spinning and carding of woolen yarns.

A very

SIMPLE WAY OF ESTIMATING

the cost of a fabric, and a fairly accurate one, is to recognize values in a hundred units, 61 of which are credited to the value of raw material, 15 to weaving cost and 24 to the cost of yarn-making processes. If the actual cost of either of the above items is known, the other costs may then be computed on the basis of the known quantity. For instance, the wool stock used costs 61 cents, and the other items in combination will figure 39 cents, plus 61 cents, which equals $1. If the yarn is bought at 87 cents per pound, the aggregate price would be the same. These units of value can be obtained by referring to our current quotations of the wool and yarn market in the American Wool and Cotton Reporter. The weaving costs are susceptible to a variation. All plain and lone-colored fabrics of simple design are woven on two or more looms, and the above weaving units of value are based on what is called one-loom work. The two or more loom work would divide the cost, if two-loom work, by two; therefore, 15 units would then become 7½ units, the yarn cost remaining 24 units and the stock 61 units.

To make the above clear, if we will take a 12-ounce fabric in which the yarn used is 2-40 worsted, costing $1.05 per pound, the material being 12 ounces in weight, or three-quarters of a pound, the price for yarns will be 78.75 cents. This price includes the stock and would represent 85 units, which figure should be used on the value they represent. 78.75 cents divided by 85 equals 9.27 cents times 15 units for weaving one-loom work equals 13.90 cents, added to 78.75 cents equals 92.65 cents, but if two-loom work, add one-half only of weaving cost, 6.95 cents, which equals 85.70 cents, the price of the fabric. Allowance must always be made for wastes in the process, and it must also be kept in mind that the manufacturer expects a profit of about 10 per cent, which, if added, equals 94.27 cents.

As we have indicated above, the value of fabrics varies according to the value of stock. In the manufacture of woolen goods as distinct from worsted goods, there is greater latitude in the selection of stock for the former than the latter. This is because the woolen process of making yarn permits the blending of all kinds of stock and also the use of substitutes, whereas the worsted system requires the use of wool approximately uniform in length of fibre; in fact, the worsted yarn-making process involves the combing out of all short fibres from the stock before it becomes yarn. These short fibres are called noils and are used extensively by woolen mills in making woolen cloth.

Generally speaking, wools come under three classifications: Low, fine

and medium. The comparative value of these wools, taking the market quotations of to-day, are: Low, 40 cents; medium, 50 cents, and fine 60 cents. These prices are for wools on what is called the scoured basis, that is, the wool is cleansed of all undesirable matter. The above prices are for both long and short fibre wools, which are known to the trade as combing and clothing wools. Prices obtained in the wool market generally favor combed wools, but the above ratio of the three values will generally run about the same.

Not only does the manufacturer of woolens avail himself of the noils from the worsted mills, but he also uses mill wastes, straight cotton and cotton wastes, shoddy made from tailors' clips and shoddy made from rags. Considerable skill is needed in manipulating the various kinds of wool stock and substitutes, the grades of substitutes varying as many times as straight wool.

CHEAP CLOTHING.

In one section of England the ability to make cloth from low rag stock exceeds all others the world over. Most of the fabrics woven are made with cotton warps and are sold at very low prices. A similar fabric is made in this country and is called satinette. This may be considered the lowest grade of men's wear clothing. In weaving, the warp yarns are woven in under a strain. On the contrary, filling when woven in only requires to carry its own weight, and for these reasons, the lowest class of fabrics mentioned above contain a warp of strong cotton yarn filled with heavy filling made of stock of the shortest fibres.

NAPPED GOODS.

One important quality required in stock for woolen goods is its felting properties. This quality enables the manufacturer after weaving to shrink his goods in the finishing process and to raise a heavy nap, the cloth still retaining a firm feel. This finish is peculiar to overcoating fabric and cannot be obtained to advantage by the use of worsted yarns, and napped overcoatings are invariably made out of woolen yarns. This brings us to the consideration of substitutes and adulteration, as a great many of these overcoating fabrics contain a blending of wool and substitutes. So far as these fabrics are concerned, cotton or its wastes are not suitable, as cotton has no felting properties. Sometimes cotton yarn is used in the warp to bind the stock of both warp and filling of a low, heavy quality, but as the amount of cotton used under such conditions is relatively small, it neither helps nor impedes the felting required.

ADULTERATION.

In making fabrics to cost less than what can be made from the cheapest clothing wool, the manufacturer resorts to substitutes. These substitutes are traded on the market the same as wool, and quotations as to current prices are found in the American Wool and Cotton Reporter in each issue under a general classification, "Rags, Shoddies, Wastes & Extracts," and other various departments. Under the section, "New Clips," will be found a list of different grades of tailors' clips. This stock is all new and of various grades.

Old stock comprises a classification of rags picked up all over the country by dealers. Flannels, knit goods, serge, merino, skirted cloth, delaines and carpet, all these grades of both clips and old stock are broken up by cards, pickers or garnetts, and the best of this stock, which is called shoddy, is used by the mills in manufacturing cloth and the balance in the making of mattresses. The wastes of the mills are also on the market. Woolen wastes are under two general classifications, hard and soft. The former has to be broken up before being utilized in the making of yarn. Soft wastes are used just as found on the market, and cotton wastes are taken both by the woolen and cotton mills. By comparing values, it may readily be seen how stock going into a fabric may be cheapened.

As wool substitutes are used in

their classification of fine, medium and low, their uses are also limited by their various shades and colors. When manufacturing goods which run to light shades, light stock only can be used, and some of the latter is difficult to use under any circumstances. Goods running to dark shades, on the other hand, can be made with a blend of wool substitutes of practically any shade. This indicates that dark wool cloths are more likely to contain shoddy than light cloth, and to a certain extent, explains why heavy clothing runs to dark shades, as the manufacturer can make his yarn with a greater percentage of shoddy, as it is necessarily thicker for heavy-weight goods. When making light shades and light-weight goods, manufacturers very generally resort to cotton which will not only spin to a fine thread but will color to the lightest shades.

NOT DETRIMENTAL TO UTILITY.

A reasonable amount of cotton used in the stock of a woolen fabric is not detrimental to its utility, nor is there any serious objection to the presence of shoddy in woolen cloth. To speak of shoddy, because it is made out of old rags, as being unsanitary is absurd, as shoddy in its preparation goes through a strong sulphuric acid bath and is dried in an oven of 220 degrees Fahrenheit, which will absolutely destroy all germs. The only real objection to the presence of cotton or shoddy in a fabric is the difficulty of determining the presence and their possible excessive use, and although the presence of either cotton or shoddy is not detrimental to the fabric, wool which they are there to replace is of better value.

BOILING OUT.

To determine the presence and proportion of cotton in a woolen fabric, take two or three square inches of cloth, dry it bone dry and weigh; then soak it in a 5 to 7 S.G. Baumé solution of sulphuric acid (oil of vitriol), removing as much of the soak as possible by using squeeze rolls (do not touch with fingers), dry and then bake in an oven at a temperature of 220 degrees Fahrenheit for half an hour, shake out all the residue and again weigh. If the first weighing was three grains and the second only 2 grains, the sulphuric acid has destroyed the cotton, which showed its presence to the extent of one grain out of three, or 33 per cent. The only practical test to ascertain the presence of shoddy is the unwinding of a thread and noting the length of fibre. By the use of a microscope it may be found that the scales or serrations peculiar to woolen fibre are rubbed off, but this is not an easy way of testing.

Russian Novelty Blanket.

The illustration, though giving an idea of the appearance of the auto robe here described, fails to convey to the mind of the observer the beauty of the fabric. Both face and back are covered with a long, silky nap, which adds materially to the effect. It is adaptable to a variety of uses and may be made in a wide range of styles and colorings. The sample shown has wide bars of color running transversely, the alternate stripes of olive, white and light brown combining to give it a beauty that cannot well be described and really must be seen to be appreciated. Designing on this particular type of fabric is confined almost entirely to effective

COLOR COMBINATIONS,

as weave changes would not be noticeable under the full, thick nap. Mills equipped with jacquards might turn their attention to fabrics constructed along similar lines and should produce styles that would meet with a ready sale and earn extremely satisfactory dividends for the stockhold-

ers, as the price of a robe at wholesale, $11.50 to $16, is several times the cost of material and manufacturing

The great disparity between cost and selling price is an additional proof of our contention that price in many instances is not based on intrinsic value, but is simply a question as to how much can be obtained. This is particularly true of

Russian Blanket.

the many novelty fabrics brought out from time to time, and is justified to a certain extent on many of the cloths that are dependent on the whims of fashion for their popularity.

The fabric is one that might well be made by any of our domestic woolen mills, as no special machinery is required in its manufacture.

The rapidly increasing use of the automobile has created a market for robes that is expanding by leaps and bounds. That greater cognizance is not taken of the opportunities offered our textile mills in this field is a matter of no little surprise. Possibly the fear that a change in the character of the demand would find them with stocks on their hands that would with difficulty be moved, has deterred some of our mills from attempting to cater to this trade. That extreme novelties are very poor property when the vogue for them is at an end is very true, but it hardly seems possible that a change in the style of robes would be so radical as to depreciate the price to a point where any considerable loss would be incurred. Then, too, the price of novelties is invariably figured on a basis that allows of a material drop in price at the end of the season, if necessary, to dispose of the small quantity in stock.

The fabrication requires a good

KNOWLEDGE OF STOCKS,

as on the stock mixture used the success of the fabric depends entirely. A feature that is somewhat out of the ordinary in the construction of woolen fabrics is the extreme disparity in weight of the warp and filling. It is not at all uncommon to find a fabric in which the warp or filling predominates, but the extreme difference noted here is rather unusual. The face texture is low, but the production will be lower than this fact would seem to indicate, as the back of the fabric is produced with a separate filling, though identical in color and stock mixture with that used for the face. The warp has 32 ends per inch of a three-run random mix, made from a three-eighths wool and shoddy. The filling is made from mohair noils, spun to three-quarters run. The most

DIFFICULT FEATURE

connected with the manufacture of this fabric is the production of the

filling yarns. As the stock used is rather short and slippery, it will require cooperation between the carder and spinner to secure good results. The roving must be made relatively fine, as the nature of the stock will permit of but little drawing on the mule.

With filling as coarse as is required to give a fabric of the desired weight, a copping machine is almost a necessity, as otherwise the looms will be stopped a great deal of the time for shuttle changing, which may be obviated to a considerable extent by means of the slight additional expense involved in the copping. The finished width of the robe is 60 inches, which will necessitate laying the warp about 77 inches in the loom, and the great weight and bulk of the fabric will require taking the pieces off about 36½ yards long, which should give 18 finished robes to each piece. The goods are fulled in the grease, well scoured, extracted and placed on the napper. When the nap has been well raised place on the wet brush, give two or three runs and steam blow them, afterward forcing cold water through them, change ends and repeat the steam and cold water treatment. Dry, shear off the long hair, brush and cut for binding.

8 harness, straight draw.

LAYOUT.

1,920 ends, 12½ reed, 2 per dent = 76.8".
48 picks.

STOCK MIXTURE.

Warp:
75% ⅜ wool @ 48c. = 36c.
25% med. shoddy @ 16c. = 4c.

16) 40c.

Per ounce ..... 2½c.

Filling:
Mohair noils @ 18c. per lb. = 1⅛c. per oz.

CALCULATIONS.

1,920 ends 3 run ..... = 6.40 oz.
10% take-up ..... = .64 oz.

48 picks ¾ run = $\frac{76.8 \times 48}{75}$ ..... = 49.15 oz.

Loom weight ..... 56.19 oz.

Finish 6 lbs. per blanket, 72" x 60".

COST.

7.04 oz. + 15% shrinkage..... = 8.28 oz.
49.15 oz. + 20% shrinkage..... = 60.14 oz.

8.28 oz. @ 2½c. ..... = $ .207
60.14 oz. @ 1⅛c. ..... = .677

Cost of stock..... $ .884
Manufacturing, 48 picks..... = .324

Net cost per yard $1.208

Double Cloth Mackinaw

The derivation of the name Mackinaw, as applied to the material for outer garments so popular at present, is explained in a variety of ways. One of the most plausible is, that it comes from the common abbreviation of Mackinac, the name of an island in the strait connecting Lakes Michigan and Huron. The name was formerly used chiefly on the upper Great Lakes and owes its origin to the fact that Fort Mackinaw was for many years the most remote post in the Northwest, and from this point a large number of Indians received their supplies, and the term Mackinaw blanket was coined to distinguish those furnished by the Government Garments made from this type of fabrics were frequently called blanket coats, but of late the name Mackinaw has superseded all others. The fabrics were originally all single cloths, well felted and practically repellent, but at present many are made in cloths of double construction and are not felted to any extent. The characteristic of the cloth is the bold design in strongly contrasting colors.

The manufacture of these fabrics has been the means of keeping many looms employed that otherwise would

have been idle for the past year or more. Coats of the most bizarre appearance have been extremely popular among the younger men and women, particularly in schools and colleges. In some instances, the college colors are skillfully blended in the cloth and a very pleasing effect is produced. The fabric presents no particular difficulty in its production and can be manufactured by any mill with ordinary fancy cassimere equipment. The fabrics are made in all grades, from the lowest cotton and shoddy combination to that constructed of pure wool. The sample we have for analysis is made entirely of well-grown shorn wool of quarter-blood grade. If wools are purchased that are well graded,

VERY LITTLE SORTING

will be required, in fact the fleeces need only to be skirted if the entire production of the mill is to be this one fabric. The skirted stock should be run through a duster if any considerable quantity of loose dirt is present, so that as much as possible may be removed before the scouring operation, the best form of duster to be used for this purpose is an open question.

Many manufacturers are opposed to the use of the cone duster or willow, as it is commonly termed, claiming that its action is too harsh and tends to shorten the fibre to a considerable degree. This feature, however, is not as prominent a factor in treating clothing wools as it would be in the case of long stapled combing wools. It is probably the most common type of duster to be found in modern woolen mills and is well adapted to the purpose for which it is constructed. The operation of the machine is very simple and requires no particular skill in its care or operation. The principle of operation is simply beating the wool by means of a revolving cylinder below which a screen is suspended that allows the foreign matter to fall through, retaining the stock. The cylinder is cone-shaped, the larger end about 48 inches and the smaller end 24 inches in diameter, with a length of approximately eight feet. The cylinder is built upon a shaft of some two inches in diameter, with spiders or arms to which wooden lags or rails are attached, usually four in number. Each lag is supplied with iron teeth projecting about three inches. At the back of the machine is a cylinder provided with short, curved or cockspur teeth, which serve to comb or open out the wool as it is operated on by the straight teeth of the main cylinder. The screen under the main cylinder is made in two parts, so that it may be readily removed for cleaning. To remove the lighter dust and chaff,

AN EXHAUST FAN

is usually provided, which is attached to the top of the duster and connected to the inside of the cover of the cylinder. In operation, a current of air is in constant motion through the duster, carrying away the dust and lighter impurities through a pipe discharging outside the mill. To prevent the stock from being removed with the dirt a suitable screen is placed below the fan opening. The lower part of the duster is made as nearly air-tight as possible, so that the air in the space below the screen will be comparatively without motion; by so doing the draft induced by the fan will not prevent the falling of the heavier portions of the dirt as they are loosened from the wool by the action of the cylinder and drop through the screen. The feeding mechanism consists of an apron of lattice on which the wool may be fed by hand or a self-feed. This apron receives its motion from a train of gears so arranged that the movement of a lever enables the operator to stop the travel of the apron. At the delivery end of the apron are a pair of cockspur rolls, which, working in conjunction with the apron, deliver the wool to the cylinder.

To operate the machine, the wool is fed to the moving feed apron and delivered to the cockspur feed rolls. The teeth of the cylinder then beat the stock, loosening the impurities, and the heavy dirt drops through the screen under the cylinder, the lighter dust, etc., being drawn off by the fan. The stock passes from the small end of the cylinder to the larger end and is discharged through an opening at

the back. The use of a machine of this character is to be commended, as it puts the stock in excellent condition for the next operation, that of scouring.

THE PROPER SCOURING OF WOOL

is an operation that requires not only a certain skill on the part of the operator, but also proper appliances and pure materials. While it is true that wools of the type used in Mackinaws are capable of standing much harsher treatment without serious injury than finer grades, it is not advisable to use harsh alkalis as detergents. It is unusual for such wools to be heavily yolked, and that being the case, a strong soap will not be necessary to cleanse them perfectly. The best material to use is a pure potash soap containing no free caustic alkali. To strengthen this, a very satisfactory product is urine substitute, or ammoniated potash. The scouring liquor need not be particularly strong and above all, see that the temperature is not over 130 degrees Fahrenheit. Strong alkalis and hot baths are responsible for a great part of the poor work in subsequent operations. The scouring bath for wools of this type may be made up with soda soaps if desired, but it is not to be advised, particularly if part of the stock is to be used in the white. The use of soda has a very pronounced tendency to produce a yellow tinge on the wool and should be avoided whenever possible. The scouring machine should have not less than three bowls, the first two containing scouring liquors, the last clear water for rinsing. A very economical arrangement is one that discharges the wool from the last bowl of the scouring machine to a traveling apron which, in turn, delivers it to the feed apron of the drying machine. By means of such an arrangement in connection with a self-feed for the scouring machine two men will be able to scour and dry ten thousand pounds of wool daily.

The mistake is often made of drying the stock too rapidly, in fact the use of artificial heat in wool drying should be avoided if practicable, as stock dried naturally will produce goods having a much better handle than can be obtained from stocks dried by artificial means. The wool is more lofty and has a decidedly softer, fuller touch. The dyeing of the raw stock is usually accomplished in round wooden "kettles" holding from 50 to 300 pounds. Better results are obtained if the kettles are not crowded, allowing plenty of room for the stock, with a sufficient bath to float and cover the wool.

The dyestuffs used may be for bottom or top chrome process, as the dyer elects, though top chromes are to be preferred, giving slightly brighter colors. Too much poling should be avoided, as the stock is liable to become rolled and difficult to open out on the cards. In the picker room the use of mineral oils should not be permitted, as they are extremely difficult to remove in the finishing process. The lubricant best suited to wool is, of course, olive oil, but its extremely high price prohibits its use on ordinary fabrics. In default of this we are forced to use a less expensive oil, and find that a

GOOD RED OR LARD OIL

will answer the purpose nicely. The emulsion may be prepared by mixing the oil and water in the proportions of two parts water to one part oil, emulsifying the mixture by the addition of a small quantity of borax or other mild alkali. The emulsion may be applied hot and after a light beating with a pole to spread the emulsion through the stock, the picking operation may be started. In the case of all wool solid colors, it will be unnecessary to put through the mixing picker but once. If there are several colors in the mixture, or a variety of stocks to be blended, it will be necessary to run at least three times to obtain a homogeneous mixture.

MANY CASES OF TROUBLE

in the finishing room may be traced back to careless or improper work in the preparatory processes. It is not unusual to find that the cause of cockles, which develop in the fulling mill, is insufficient mixing of the stocks in the picker house. Difficulty in scouring fabrics is frequently caused by the use of an oil on the

stock which does not readily saponify, or may be traced still farther back to the wool scouring, where improper handling or the use of hard water may have had an effect on the wool that will require much time and labor to remedy.

The carding of stocks such as these is comparatively simple, as the wools are open and lofty with little or no short fibre to create pills or nibs. The clothing should be in good condition, the workers not set too close, yet with sufficient contact to comb out the stock and complete the mixing. The condensers need not be set close, as the stock will make good roving without hard rubbing. In using all wool for the mixture, the roving may be made heavier than would be possible were there any considerable quantity of short stock used. This will enable the carder to produce roving enough from two cards to keep three ordinary mules busy and

REDUCE HIS EXPENSE

per pound to a very satisfactory figure. With well-made roving from quarter-blood stock the mules should not stop from start to finish of a set, except for piecing in spools or work of that nature. It should be no trouble for a spinner to keep his ends up, as breakages from any cause should be very rare. Yarns spun well should be even, full and round, with sufficient elasticity to permit of stretching at least four inches to the yard. From such yarns it is possible to dress warps that will give maximum production in the weave room. The spooling is a very important operation, though by many not so considered if results are to be the basis of opinion. The knots must be tied in such a manner as to avoid slipping and without long ends to twist around the other threads in weaving. The tension must be alike on each thread and spools made free from holes or double ends. It is frequently said that a warp well spooled is half dressed, and anyone who has had experience with both classes of spooling will readily confirm the truth of the proverb. The dressing may be done at fairly high speed with good yarn well spooled, but too much tension should not be placed on the spools. The ideal warp is one free from threads out, with sections even, and all the

LIFE AND ELASTICITY RETAINED

in the yarn. With these conditions fulfilled the lot of the weaver should be comparatively easy. With the loom in good shape, the speed may be 100 picks a minute and give perfect results, as the weave is not hard nor the harnesses crowded. When the warp is started, the fixer should see that the loom is in as nearly perfect condition as may be, every nut tight, the boxes and picking motion as well as the head motion timed correctly, and the shuttles smooth, free from defective eyes and with sharp points. Examine the pickers, see that they throw the shuttle straight and that picker and power straps are in good condition. The stop motion should be inspected and oiled, as it is not easily reached when the cloth is weaving.

After measuring and inspecting in the weave room, the pieces are ready for the burlers. For this operation the girls should be furnished with a sloping table with perfectly smooth top, preferably of metal, which will enable them to detect the knots very readily, as the hands are passed over the surface of the goods. Remove all foreign matter, slugs, etc., and mark all imperfections which require the attention of the sewers. After the pieces have been burled and sewed they should have some work on the napping machine in the grease. This is not customary in finishing cassimeres, and is not necessary in finishing Mackinaws composed entirely of wool, but is very essential on low-grade goods.

THE FULLING

will not require much time nor a strong soap. A very satisfactory fulling soap for all wool goods may be made up with a pure neutral palm oil soap, built up to the requisite strength with a good alkali. Care must be taken to have the soap evenly distributed over the pieces or uneven fulling will be the result. Heavy Mackinaws will need to be fulled to within an inch of the fin-

fished width, as they will go up in width very little in subsequent operations. From the fulling mills they should go at once to the washers and usually may be scoured without the use of additional soap. The goods should be first washed with warm water to float out all the dirt and grease, then rinsed for 20 to 30 minutes in cold water; before removing from the washer a quart of ammonia may be added to the rinse water, which will brighten the colors somewhat. After drying give a run on the brush and then shear to even up the nap and remove any long fibres, give a light press, inspect and roll up.

LAYOUT.

2,688 ends; reed 9½—4 = 70.7" + 1½" for listing = 72.2" over all.
48 picks.

CALCULATIONS.

2,688 ends 2 run = 13.44 oz. +
7% ..... = 14.38 oz.

48 picks 2¼ run = $\frac{48 \times 72.2}{225}$ .....= 15.40 oz.

Loom weight ..... 29.78 oz.

COST.

29.78 oz. + 15% shrinkage.....= 35.03 oz.

35.03 oz. @ 40c. per lb.....= $ .87575
Manufacturing, 48 picks .....= .35000

Mill cost $1.22575

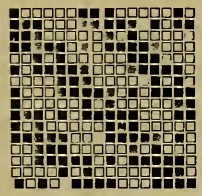
Dressed:

Mixture	112	24	12	40	12	24	112	336
Black	32	12	12	12	12	32		112
								448
								*6
								2,688

*Sections.

Filling:

White	32	12	12	12	12	32		112
Mixture	116	24	12	48	12	24	116	352
								464



BANNOCKBURNS

The name Bannockburn is now applied to a number of cloths which are not even remotely related to the true type of fabric of this name. The origin of the peculiar cloth bearing this name is a subject of dispute, but all agree that it was originated in Scotland, some claiming the honor of its introduction to a Galashiels weaver, others as stoutly maintaining that the first Bannockburn to be sold as such was the product of an Alva loom. Be that as it may, the typical Bannockburn tweed is now well and favorably known wherever the English language is spoken. The fabric, while in construction very similar to the ordinary Scotch tweed, having practically the same texture and manufactured from the same stock, differs materially in appearance. The fabrics commonly known as tweeds are made from threads of two-ply yarns, alternated with a thread of single, as are the fabrics here described. The distinguishing feature of the cloth under discussion is the fact that in making the two-ply thread, commonly termed

Double and Twist,

the two threads used for producing the finished yarn are of contrasting colors, while in the ordinary tweed the single threads are of the same color, and when twisted show comparatively little of the twist effect. To anyone at all familiar with textile manufacturing, it is not necessary to state that the use of two colors in producing a double and twist thread permits of developing a variety of styles of singular beauty. By the judicious selection of colors for the primary threads and good taste in combining them on the twisting frame, it is possible to produce an extremely satisfactory line of twists, which the skilled designer, with his knowledge of weaves, may blend

into fabrics that will please the most fastidious dresser, or, on the other hand, produce cloths that will delight the eye of the young man who wants a garment that is stylish and nobby.

In the manufacture of the higher grades of Bannockburns, nothing but pure wool is used, and this should be, preferably, of high-quarter or three-eighths grade, selected from bright, well-grown wools, full of life and elasticity. The drugs used in dyeing the stock must be selected with a view to securing colors that are

Bright and Lively,

or much of their effectiveness will be lost. The carding and spinning of the threads for making the twist will require especial care, or the resultant yarns will be far from satisfactory. While in an ordinary tweed or cassimere a slight unevenness of the thread will make no appreciable difference in the finished goods, the direct opposite is the case with fabrics made from double-colored twists. In fact, the most prevalent and annoying defects to be found in this type of fabric are caused by variations in the twist, resulting from uneven yarns.

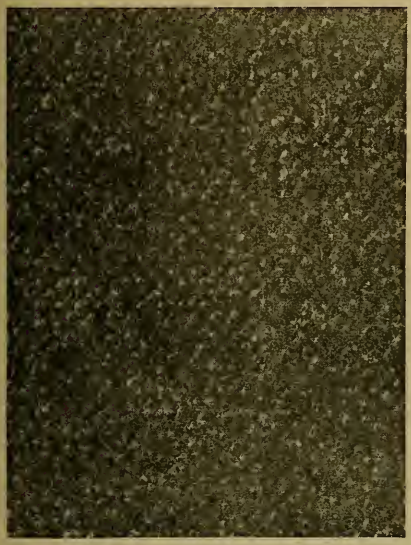
The carder will need to pay particular attention to the size of the roving, see that the side ends are not light or heavy, watch the weight of top and bottom spools on the finisher, and see that the roving goes to the spinner in as nearly perfect condition as possible. A frequent cause of trouble is defective feed rolls. The rolls may be slightly sprung and the clothing or the gears so badly worn that at times a tooth slips by and allows an excess of stock to be carried to the cylinder. The stock used in the sample analyzed is a mixture of 85 per cent wool and 15 per cent shoddy for the twist threads and the single warp, while the single yarn in the filling is spun from a blend of 50 per cent wool and 50 per cent shoddy. By using a mixture of this grade for the manufacture of the twist threads, a good production is assured from the cards, as the roving will readily admit of spinning at half-draft for the four and a quarter run. The twist in the single yarns for making the two-ply should be left hand, the finished thread twisted 12 turns to the right, making a thread equal in size to a two-run single. The 3¼-run warp may be spun two-thirds draft, twist to the right, and the 2½-run filling should be spun half-draft, twist to the right. Warps made from the stock described will require no sizing, so may be made on the dry dressing frame. The use of long pins on the reel will admit of building the sections to such a height that a long warp may be made, which, by using a warp compressor, may be placed on the ordinary beam without using undue friction on the reel during beaming. Even if the extra length of warp on each beam is not an advantage at all times, the use of the compressor is strongly advised, as warps on which it is used invariably give much better results in the way of more nearly perfect work and increased production in the weave room, owing to the lessened strain on the yarn in the beaming operation, and the

Preservation of the Elasticity

of the yarn. To anyone at all familiar with textile manufacturing, the great advantage derived from the latter feature will be readily apparent, as it is obvious that the less a yarn is strained in previous operations, the better it will be able to endure the stress incident to the intermittent action of the reed in beating the weft into the fell of the cloth.

The finishing must be well looked after, if the best possible results are to be secured. Burling is a simple operation, requiring no special skill, but care must be used in removing the knots, lest the ends be broken off so short that in further processes they do not shrink back, leaving the defect commonly known as pin holes. The sewers must be instructed to replace all coarse and uneven twist, as imperfections of this nature are one of the most frequent causes of claims. Much of this could be avoided by having the

twist yarns sorted when taken from the twister, rejecting bobbins which are imperfect, thus preventing their being woven into the cloth, and causing not only much extra labor but oftentimes very serious loss. Goods made from straight wool mixtures may be fulled in the grease, but if there is any suspicion of danger of staining the light colors used in the twist, a preliminary scouring would be advisable. Bannockburns should be fulled to the finished width, dried an inch wider, and the operations of dry finishing will again shrink them to the correct width. In general, these fabrics are not closely shorn, and are finished to loom length.



18-Ounce Bannockburn, 56 Inches Wide.

Layout for 18-oz. fabric:

2,016 ends, reed, 7½ × 4 in dent = 67.2" plus 2" for listing = 69.2" over all.
32 picks.

Warp:

1,008 ends 2/4 run D. T.	5.04 oz.	
Plus 10% loom shrinkage		5.54 oz.
1,008 ends 3¼ run	3.07 oz.	
Plus 10% loom shrinkage		3.37 oz.
	8.11 oz.	8.91 oz.

Filling:

32 picks per inch × 69.2" = 2,214.

1,107 picks 2/4 run D. T.	5.53 oz.	
Plus 10% loom shrinkage		6.08 oz.
1,107 picks 2½ run	4.42 oz.	
Plus 10% loom shrinkage		4.86 oz.
Finished weight	18.06 oz.	10.94 oz

COST CALCULATION.

Material:

The black and white yarns used for the 2/4 double twist, are spun ½ draft, twist to left, 4¼ run, allowing 6% take-up in twisting, then twisted together, 12 turns per inch to the right. The 3¼ run mixture warp yarn is made from the same blend of stock spun 2/3 draft, twist to the right.

85% med. wool @ 45c..... = $ .3825
15% shoddy @ 33c..... = .0555

16) $ .4380

An ounce .....$ .0274

Warp:

Black and white 2/4 run D. T. = | 1 | | = 1
Mixture 3¼ run = | | 1 | = 1

2 × 1.008 = 2.016 ends.

Filling, 32 picks:

Black and white 2/4 run D. T. = | 1 | | = 1
Black, 2½ run = | | 1 | = 1

2

The black 2½ run filling is spun ½ draft twist to the left.

50% med. wool @ 45c..... = $ .2250
50% shoddy @ 33c..... = .1650

16) $ .3900

An ounce .....$ .0244

CHAIN DRAFT.

STRAIGHT DRAW.

Note—Twill runs to the left on face.

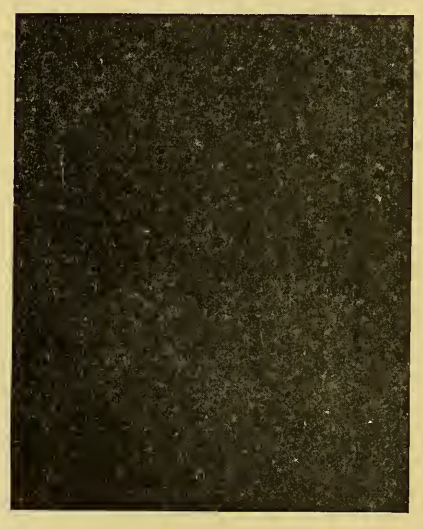
5.54 oz. 2/4 run D. T. warp.
6.08 oz. 2/4 run D. T. filling.
3.37 oz. 3¼ run warp.

14.99 oz. + 15% shrinkage = 17.24 oz. @ $.0274	=	$ .4724
4.86 oz. 2½ run filling + 15% shrinkage = 5.59 oz. @ $.0244	=	.1363
		$ .6087
Manufacturing: 32 picks		.2590
Mill cost		$ .8677

Loom weight, 22.83 oz.

22 2-10-OUNCE BANNOCKBURN SUITING.

The 22 2-10-ounce, 56-inch wide bannockburn is made with heavier yarns and lower-priced stock blend than in sample of 18-ounce just described.



22 2-10-Ounce Bannockburn, 56 Inches Wide.

Layout:
1,920 ends, reed 7 × 4 in dent = 68½" inside of listing; plus 2" for listing = 70½" over all.
28 picks.

Warp:

A Black and white D. T. 2/2½ and 3½ run	1		1		= 2 × 480	=	960
B Black and red D. T. 2/2½ and 3½ run		1			= 1 × 480	=	480
C Black and gold D. T. 2/2½ and 3½ run				1	= 1 × 480	=	480
					4 × 480	=	1,920

Filling:
28 picks.
Black 1¾ run.

COST CALCULATION.

Material:
The black for double twist is spun ½ draft, twist to the left, to 2⅝ run, allowing 5% take-up in twisting.

50% med. wool @ 45c	=	$ .2250
50% shoddy @ 18c	=	.0900
	16)	$ .3150
An ounce		$ .0197

The white, red and gold for double twist is spun ½ draft, twist to left, 3⅝ run to allow about 4% take-up in twisting.

70% med. wool @ 45c	=	$ .3150
30% shoddy @ 33c	=	.0990
	16)	$ .4140
An ounce		$ .0259

2/2⅝ and 3⅝ run warp D. T. is twisted 11 turns per inch to the right.

58% black 2⅝ run @ $.0197	=	$ .0114
42% color 3⅝ run @ $.0259	=	.0109
Cost per ounce		$ .0223

The black filling is spun ½ draft 1¾ run twist to the right.

70% shoddy @ 18c	=	$ .1260
30% med. wool @ 45c	=	.1350
	16)	$ .2610
An ounce		$ .0163

CHAIN DRAFT.

STRAIGHT DRAW.

Note—Twill runs to the left on face.

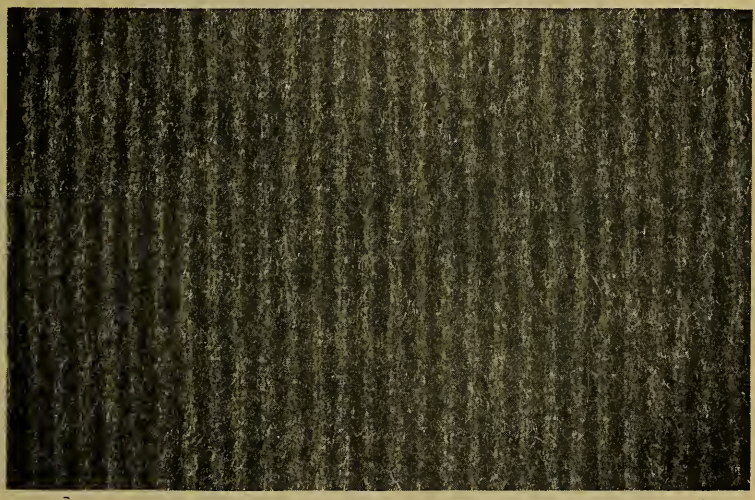
Warp:		Filling:	
1,920 ends 2/2½ and 3½ run ....10.97 oz.		28 picks × 70½" = 1,974 picks 1¾ run.....11.25 oz.	
Plus 10% loom shrinkage	12.06 oz.	Plus 10% loom shrinkage	12.37 oz.
		Finished weight .....22.22 oz.	24.43 oz

12.06 oz. 2/2⅝ run warp + 15% shrinkage ....=	13.87 @	$.0223 =	$ .3093
12.37 oz. 1¾ run filling + 20% shrinkage .....=	14.84 @	.0163 =	.2419
	28.71 oz.		$ .5512
Manufacturing: 28 picks			.2420
Mill cost			$ .7932

Loom weight, 28.71 ounces.

HAIR LINE DRESS GOODS

The hair line and tricot are very closely allied fabrics, and a few years ago formed the major part of the output of many of our woolen mills. The cloths were made in a great variety of weights and colors for both men's and women's wear. By changing the color arrangement in the dressing pat-



Hair Line Dress Goods.

tern it is possible to make a variety of widths of stripes. The patterns most in vogue were the single thread hair line and the double thread stripe shown in the illustration at the head of this description. The weave employed for the production of the hair line is the four-harness broken twill, three up and one down, and is used in the lighter weights without either warp or filling back. The goods were invariably made with a

Clear Finish and from Fine Wools.

At the present time they are manufactured in very small quantities, the vogue having been superseded almost entirely by other styles. The most recent example of the fabric which has come to our notice is one made

from coarse stock, with a semi-cheviot finish in overcoating weight.

The fabric illustrated is primarily intended for use as dress goods and is made from a fine medium wool in two shades of mixture. The blends must be thoroughly mixed in the picker room so as to avoid the

Blotchy Appearance

that is characteristic of so many of the mixtures shown by mills where attention to detail is not, to say the least, carried to extremes. To produce the best results on fabrics of this character, particular attention should be given to the selection of the wools used for the light colors in the mixture, as by so doing the danger of specks can be eliminated to a very marked degree. The wools should be free and open, with no sign of "pills" or nits. The cards must be in excellent condition, the clothing true and sharp, and set close enough to give a clean, clear sliver from the second breaker. As the stock used is a fine clear wool it will be possible to make the roving fairly heavy, half draft at least. That is to say, the weight of 25 yards of roving will equal that of 50 yards of yarn. This will not only give a relatively larger production from the card room but will allow sufficient drafting on the mule to insure a well made, round, elastic thread that will give an excellent account of itself in the weaving and finishing processes. Hair lines of the type here described are

Not Felted to Any Extent,

and are therefore laid comparatively narrow in the reed. Indeed, to many who are accustomed to the heavier, finer fabrics for men's wear purposes, it may appear that the width given in our layout is entirely inadequate to produce the desired results. This is not the case, however, as the layout here given is not theoretical, but is taken from actual mill practice, and has been found to give excellent results. The scouring may be done before fulling, or may follow that operation, as the judgment of the finisher may indicate. When dry, the pieces should be well brushed, and should shear out sufficiently clear without the application of the napping process. After shearing, brush, spray and press.

9 3-10-Ounce Hair Line Dress Goods.

Layout:
1,664 ends, reed, 13 × 2 in dent, 64" + 2" for listing = 66".
26 picks.
Four harness.

STRAIGHT DRAW.

HARNESS DRAFT.

Warp:

A Light mixture	3½ run	| 2 |	| |	= 2 × 416 =	832
B Dark mixture	3½ run	| |	| 2 |	= 2 × 416 =	832
				4 × 416 =	1,664

Filling:
26 picks per inch × 66" = 1,716.

A Light mixture	3¾ run	| 1 |	| |	= 1
B Dark mixture	3¾ run	| |	| 1 |	= 1
				2

1,664 ends 3½ run warp 4.72 oz.
Plus 10% loom take-up 5.05 oz.
1,716 picks 3¾ run filling ..... 4.57 oz.
Plus 5% loom take-up.. 4.75 oz.

Finished weight..... 9.29 oz. 9.80 oz.

COST CALCULATION.

Material:
Warp and filling:
Med. wool @ 54c..... = $ .5400

16) $ .5400

An ounce .....$ .0337

The warp yarn is spun ½ draft 3½ runs, twist to right. The filling is spun ½ draft 3¾ run, twist to right.

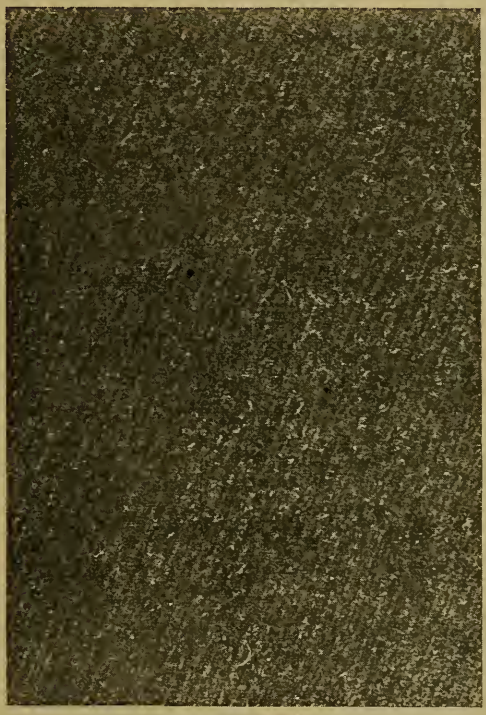
9.80 oz. + 12% shrinkage = 10.98 oz. @ $.0337.....= $ .3695
Manufacturing: 26 picks ..... .2340

Mfil cost (per yard).....$ .6035

LADIES' COATING FABRIC

Changeable in Shade.

Nothing is more subject to the vagaries of fashion than the fabrics used for ladies' coats. Some twenty years ago various types of bouclés were very much in evidence and have been superseded by a variety of novelty cloths until the cycle has been completed, and the bouclé is once more in favor. Not many years have elapsed since the fabric here described and illustrated was extremely popular for spring and fall jackets, while at the present time it is doubtful if such a cloth could be marketed at any price.



11-Ounce Ladies' Coating Fabric.

The peculiar characteristic of the fabric is obtained, not alone by the weave or color, but by a tasteful combination of the weave best adapted to bring out the effect and well-selected shades of warp and filling in contrasting colors. The general effect is a two-toned cloth, changing color as the angle of vision changes. These cloths are finished clear, so as to imitate as nearly as possible a fabric made from worsted yarns.

Contrary to the general opinion, this effect is not to be obtained by giving excessive twist to the yarn, but rather by using less than the standard number of turns to the inch. Those conversant with the method of manufacturing both types of yarn will readily appreciate the reason for reducing

the twist. In the manufacture of worsted yarns, it will be remembered, the method pursued is to draft endwise, constantly reducing the size of the drawing until a roving is produced small enough to spin to the required number. The resulting thread is one that has its constituent fibres laid parallel to each other and extended to their full length. As the eye looks on the finished thread it sees only the sides of a bundle of fibres. Woolen yarns, on the other hand, are not made by endwise drafting, nor is the parallelization of the fibres a feature of the system of manufacture. The combing effect of the card is neutralized to a great extent by the method of taking the stock from the doffer. Instead of removing the web in the direction of its line of motion through the card itself, it is drawn off at right angles through a tube at the side, and this "side drawing," as it is

Placed Diagonally

on the feed table of the next machine. In forming the roving for the mules, the procedure is very different from the gradual reduction of the worsted sliver by successive draftings. The wool is removed from the rapidly revolving cylinder, by the ring doffers, whose surface velocity is only a fractional part of that of the cylinder, which deposits on them a very much jumbled up mass of fibres, which are anything but parallel.

In the spinning operation, it is true there is a certain amount of drafting, but nothing like sufficient to place the fibres parallel. In looking at a woolen thread the eye gets a view of a tangled mass of fibres lying in all directions, with the ends and sides presented indiscriminately, and the greater the amount of twist in the yarn, the greater the confusion of fibres resulting. To approximate the appearance of a worsted thread, therefore, the less the effect of the drawing on the mule, should be neutralized by twisting. To obtain the best results on fabrics of the type here described, it is necessary that the selection of the wools to be used receive careful attention. The stock must be fine, with good staple and more than average felting qualities. The

Fine Medium or Half-Blood

Montanas possess these characteristics and will be found peculiarly adapted for the purpose. The fleeces should be carefully sorted, the paint and large masses of burs clipped out. In scouring stock of this grade, no harsh detergents should be used, nor should the scouring bath be over 125 to 130 degrees Fahrenheit. Excessive heat and improper materials used in scouring will have a very serious effect on the working qualities of the wool. Another source of injury to the wool fibre that is frequently overlooked is the use of too great heat in the drying. If time will permit, no better method of drying wool can possibly be used than the so-called cold air system. This method consists of placing the wool in a suitable screen or dryer and forcing air, at the normal temperature of the room, through the stock. This method retains all the life and vitality in the stock, with no impairment of its working qualities.

The importance of retaining, as far as possible, the natural characteristics of the wool fibres is too often lost sight of in the rush to get the raw stock into finished goods in the shortest possible time. This is a very serious mistake, and is responsible, largely, for the fancied superiority of the fabrics made abroad. The gain in time is more apparent than real, and the necessity for such undue haste can readily be overcome by making systematic plans for the work to be accomplished. It will invariably be found that in the mill where lots have to be rushed through the various departments to avoid delaying some advanced operation, the

Fundamental Defect

is a lack of system which might be easily remedied, with a marked increase of efficiency, and a notable improvement in results. When dry, the wool

may be taken to the dyehouse, frequently the source of much subsequent trouble. To one unfamiliar with the woolen business it may seem strange to have the statement that the "wool was burned in the dyehouse," but that is a familiar tale from the carder when questioned as to the reason for a certain lot running so badly. That irreparable injury may be done the wool during the dyeing is a fact too often verified in actual experience to need any proof here. Excessive boiling is one very common cause of serious trouble in the card room and should be avoided in every case. It is impossible for the best of dyers to get the desired shade at the first attempt every time, but care in poling the wool and good judgment in using the shading colors will do much toward lessening this evil. When colored and dried the stock is ready for the picker house, and if it contains burs

Should Be Run Through the Bur Picker

for their removal. The batches for these fabrics are usually solid colors, and may be oiled and run through the mixing picker once, which should put them in condition for the cards. Before placing the lot on the cards, they should be ground if necessary, and the setting adjusted for the stock. Better results will be obtained from a set clothed with fine wire. For yarns of this size and quality the first breaker should be clothed with wire not coarser than 32, with 34 on the second breaker and finisher. Make the roving three and a half run for the warp and three run for the filling, which will give draft enough to make a smooth, strong thread with medium twist. No sizing should be required in the dressing, though many manufacturers will not agree with this statement.

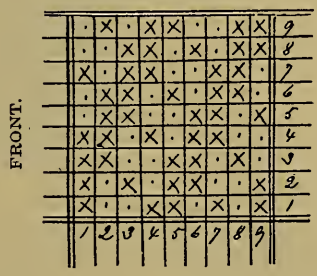
The weave used is usually the nine or ten harness whipcord, not an especially hard weave, and should give excellent results in the way of production with a minimum of imperfections due to warp breakage. Burling and sewing follow the usual routine and the goods should be fulled to 56 inches before scouring. Do not trap in the mills as the goods are to finish loom yards. From the fulling mills, transfer at once to the washer, where they must be scoured thoroughly clean. Dry, shear, brush and press. To avoid rolling of the listings use two extra harnesses, drawing the listing two in a heddle and weave two up and two down.

Ten harness. Whipcord.

Repeat after five.

STRAIGHT DRAW.

Nine harness. Whipcord.



STRAIGHT DRAW.

Layout:
3,600 ends, 46 picks.
Reed: 13—4—69.23″ between listing.

Warp:
3,600 thr., 6½ run ..... 5.54 oz.

Filling:
46 picks, 6 run, ... 5.46 oz.
11.00 oz.
10% loom take-up ..... 1.10 oz.
Loom weight .....12.10 oz.

COST CALCULATION.

Warp and Filling:
Fine grade wool @ 3½c. an oz..... = $ .5600

Material:
12.10 plus 15% shrinkage
13.92 oz. @ 3½c. ..... = $ .4872

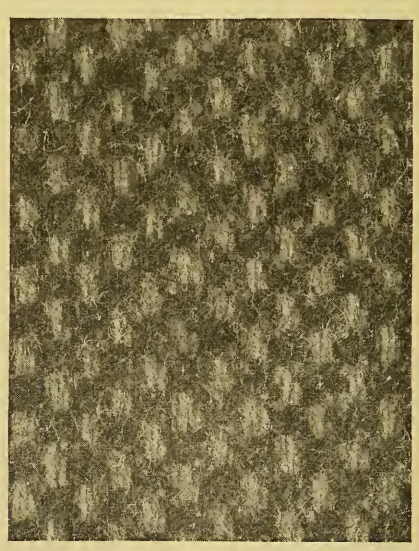
Manufacturing:
46 picks ..... .3160
Mill cost ..... $ .8032

To cheapen this fabric use 25% fine shoddy in filling.

MIXTURE OVERCOATINGS

Finished 24 Ounces.

The overcoatings here illustrated are made from heavy yarn, frequently in rather bold designs, and when well-tailored have the nobby appearance that appeals to the man who wants something stylish but not extreme. The wools used are well-selected, bright fleeces, which aid very materially in



24-Ounce Fancy Overcoating.

giving character to the fabric. The fancy 24-ounce fabric is made with a very light mix or a white warp, with dark mixture or solid-colored filling. This tends to

Emphasize the Weave Design,

and throws the light spots into bold contrast. Opportunities for the designer to show his skill in weave formation are well afforded in cloths of this

nature, as the contrast in color of warp and filling is of great assistance in making the patterns well defined.

In selecting the wools to be used for the white in the mixture, special attention should be paid to its freedom from the extremely short fibres which are apt to form nibs during the carding, and cannot be opened up thoroughly, forming specks, a defect that must be avoided at all hazards. Have the stock well sorted, and scour with a pure, well-made soap in a bath not exceeding 120 to 130 degrees Fahrenheit in temperature. The portion of wool intended to be used for white, either in mixture or solid, need not be dried but placed in

The Bleaching Liquor,

which has previously been prepared. Of the many methods of bleaching in common use, the most feasible for the mill without special facilities is probably the use of bisulphite. This simply requires a clean dye-tub, and gives excellent results. The operation is extremely simple, and may be undertaken by any dyer without fear of injuring the stock or failure to secure a good bleach.

The bath is prepared with 60 pounds of bisulphite of soda and 10 pounds of sulphuric acid in 500 gallons of water. This is sufficient for 300 pounds of wool. The wool should be well poled for a short time to insure thorough

BASKET LEAF TWILL.

STRAIGHT DRAW.

Warp:
Bleached white medium wool.

Filling:
Plain black or gray mixture; also made in herringbones.

FOUR-LEAF TWILL, FACE AND BACK.

STRAIGHT DRAW.

Layout:
2,280 ends, 32 picks.
Reed 7½—4—76 inches between listing.

Warp:
2,280 thr., 2 run ..... 11.40 oz.

Filling:
32 picks, 2 run ..... 12.50 oz.
.2" for listing.

23.90 oz.
10% loom take-up ..... 2.39 oz.

Loom weight ..... 26.29 oz.

COST CALCULATION.

75% medium grade wool @ 44c.....	$ .3300
25% medium grade of shoddy @ 20c.....	.0500
16)	$ .3800
An ounce	2.12½c.

Material:
26.29 plus 15%; 2.75 shrinkage.
29.04 ounces @ 2.12½c..... $ .6171

Manufacturing:
32 picks ..... .2590
5% cloth shrinkage ..... .0462

Mill cost ..... $ .9223

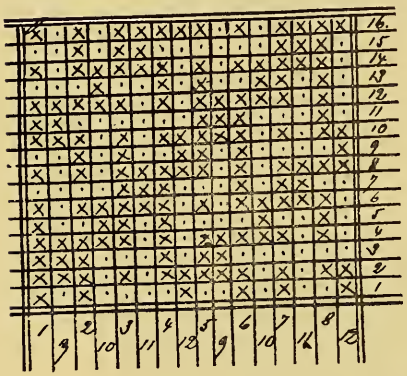
penetration of the bleaching liquor, and allowed to remain four or five hours, or still better, overnight. In the morning draw off the kettle, allow the stock to drain for a short time, extract and dry. Many superintendents object to the dead white of the bleached stock, which may be corrected by the use of a thin blue. A small percentage of a blue similar in type to S.K.Y. will change the shade of the resulting mixture to the steely tone which the

majority of buyers prefer to the effect of the clear white. Have the stock well mixed in the picker room, using four quarts of oil to the hundred, insuring ease of carding with little or no breaking of the fibre, and consequently

Much Less Waste.

A very common mistake made at this point in manufacturing is the application of too little oil, or the use of an inferior grade. This is an instance of "saving at the spigot, and wasting at the bunghole," characteristic of some managers. The extra expense involved by the use of good oil in sufficient quantity to thoroughly lubricate the fibres will be more than overcome by the superior quality of the product and the greatly increased yield of yarn from a given weight of stock laid down at the picker. On the thorough performance of the work in the picker room the success of subsequent operations depends very largely. The superintendent would do well to personally supervise the weighing and oiling of every batch, making sure that each lot is made up exactly as it should be. In carding, the ambition of the

MAYO TWILL FACE.
FOUR LEAF TWILL BACK.
FULL DRAFT.



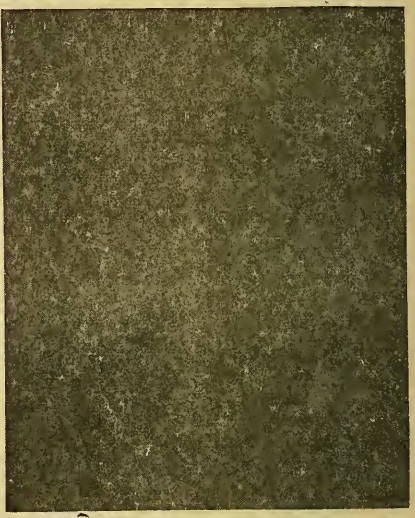
Warp:
Gray mixtures, 10% bleached white medium grade wool.

Filling:
Plain black.

Layout:
2,640 ends. 38 picks.
Reed 9—4—7⅜ 1-3 inches wide between listing.

Warp:
2,640 thr., 2 run ..... 13.20 oz.

Filling:
38 picks, 2 run ..... 14.30 oz.
27.50 oz
Loom take-up, 10% ..... 2.75 oz.
Loom weight ..... 30.25 oz.



27½-Ounce Overcoating.

COST CALCULATION.

Made from same stock as above, 2.12½c. an oz.
Material:
30.25 oz. plus 15% shrinkage.
4.53 oz.
34.78 oz. @ 2.12½c ..... $ .7390

Manufacturing:
38 picks ..... .2830
5% a yard cloth shrinkage ..... .0540
Mill cost $1.0760

overseer should be to produce the greatest possible weight of perfect roving from each lot. The use of the adjective is intentional, as it will be readily appreciated that only from perfect roving can the spinner make perfect yarn. Too many carders are able to see but one process, that in which they are particularly interested, and are prone to place the blame for inferior work on the dyer or the stock, when, in many instances, it belongs in his own department. To obtain perfect cloth it is absolutely essential that each department head work in harmony with the others, but cases are often found where each overseer seems rejoiced to slight his work to a degree not easily discoverable and make trouble for those in charge of further processes. It is especially essential for the carder and spinner to work together, as the processes are related as closely as the fingers to the hand. Production may be greatly increased by mutual co-operation in these departments. A slight change in the draft on the mules will enable the carder to secure a substantial increase in his output, while a change on the cards may make a material difference in the work on the mules.

The roving should be made about two-thirds draft, medium twist to the right in the warp, with the filling twisted to the left. The installation of wide gauge mules with special long spindles for spinning warp yarns will give a

Considerable Increase of Production

over the standard gauge found in most of our fancy cassimere mills. One reason that so few are used is probably the fact that it would cause the purchasing of new jack spools and bobbins, which could be used only for making warp. This objection has but little weight in fact, as the danger of mixing bobbins is practically negligible, while, when the same bobbins are used for both warp and filling, there is a possibility of having a few bobbins of filling spooled with the warp, causing a vast deal of trouble in the weaving and finishing departments. The looms should be provided with beams having extra large flanges, in this manner reducing the stoppage incident to putting in new warps, and also making a noticeable decrease in the waste from thrums and head ends. Burling and sewing should be carefully done, the pieces then being taken to the wet finishing department.

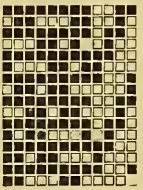
Fulling should be done in the grease, if possible, not only to save time, but as a matter of economy in materials as well. Scoured fulling involves the use of more soap, and is not to be advised except in cases where absolutely necessary. The soap used should be a pure neutral base, as the necessary alkali can be added in the boiling tank at a much less price than that paid for soap. The best soap to use is one for the finisher and superintendent to decide. Some of our expert finishers refuse to use tallow soaps under any circumstances, while others think it impossible to

Get the Best Results

without at least a percentage of tallow soap in the fulling mixture. Apply the soap cold, leaving the door of the mill open until the soap has been taken up by the cloth, then close all doors, examining the goods from time to time to see that the work is progressing satisfactorily. Full to 56 inches in width, with 5 per cent shrinkage in length. This should give a firm, well-handling cloth. Scour for 30 to 40 minutes in warm water, rinse well, extract and take to the napping machine. One or two light runs should give the nap required, and the pieces may then be dried. Shear off the long fibres, give a run on the steam brush and a moderate pressing. A fabric made in this manner will give excellent service in the garment.

The plain mixture overcoating shown is made from the same stock and

size of yarn as the novelty just described. The face is woven with the Mayo twill, the back with the regular four-harness, two-up-two-down twill. The greater weight is obtained by using a higher texture in both warp and filling. Great care should be used in making the mixtures to avoid having them uneven in appearance in the finished goods. Manufacturing instructions are the same as for the fancy fabric.



CHAIN.

DRAWING-IN DRAFT.

FRIEZE

This is a coarse, heavy woolen fabric used for ulsters, having an irregular nap and a somewhat harsh handle. The name was originally given to a coarse fabric from Friesland, later applied to overcoating cloths manufactured in Ireland from the coarse native wools, the common designation of the fabric of late being "Irish Frieze." A few years ago a large percentage of the ulsters worn were made from cloths of this type, but at present the styles demand a cloth made from entirely different types of wool, with the majority of them manufactured from chinchillas or other long-napped fabrics. The frieze, well made, is one of the best cloths ever produced for overcoating purposes, its construction, finish and the stock used making it practically repellant.

Our type sample was made from a very coarse wool combined with a coarse extract and wool waste. While this may appear to the uninitiated to be rather illy-adapted for the production of a fabric intended to withstand considerable hard usage, the resulting fabric is one that is unusually good value for the price, and will give the wearer most excellent service in the garment. In order to obtain the

Greatest Possible Profit

in manufacturing fabrics of this character, the mill should be equipped with the machinery to make its own shoddy. The goods are very heavy, shoddy being the chief constituent, and the folly of paying a shoddy manufacturer a profit on the major part of the stock used in the mill is readily apparent, particularly as the machinery installation required is comparatively inexpensive. At the present time, rags may be purchased graded, ready for the picker. The machinery necessary consists of a shoddy picker, possibly two, a lumper and duster. The power required is comparatively little, nor would the pay roll be increased to a great extent. The rags should be laid out for picking in the same manner as a batch of wool. Successive layers are placed on the floor and well oiled. Better results will be obtained if there is sufficient time allowed for the oil to thoroughly penetrate the stock before the picking operation is started. After picking, the stock should be run through the lumper and duster, which will remove the bits of cloth that have not

been thoroughly converted into fibre by the picker. When laying out the batch for the mixing picker, the layers of stock should be so arranged that the emulsion used as a lubricant is applied to the wool. If the styles to be produced are solid colors for piece-dyeing, two runs through the mixing picker should be sufficient, but should it be desired to make a mixture with a

Small Percentage of White

or some other color, great care must be observed to have the mixture homogeneous, and avoid the blotchy appearance sometimes found, due to insufficient blending in the picker room.

DRAFT.
STRAIGHT DRAW.

Warp and Filling:
In all variations of mixtures, black, brown and blue, with small percentage of bleached white.

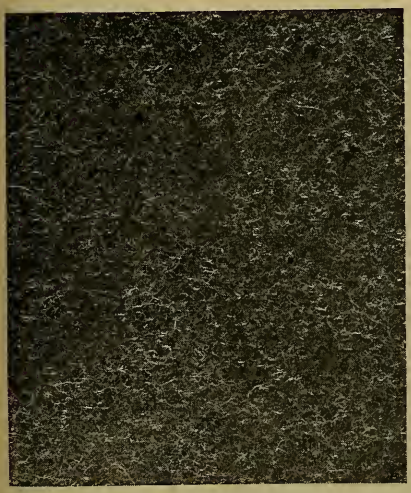
Layout:
1,600 ends, 24 picks.
Reed: 5½—4—72.72" between listing.

Warp:
1,600 thr., 1 run .....16.00 oz.

Filling:
24 picks, 1 run .....17.93 oz.
2" for listing.

33.93 oz.
10% loom shrinkage ..... 3.39 oz.

Loom weight .....37.32 oz.



34-Ounce Frieze.

COST CALCULATION.

Material:
25% coarse grade wool @ 32c. = $ .0800
60% c'rse grade shoddy @ 14c. = .0840
15% wool waste @ 10c..... = .0150

16) $ .1790

An ounce .....$ .0112

37.32 oz. plus 15% shrinkage.

Material:
42.91 oz. @ $.0112 ..... = $ .4805

Manufacturing:
24 picks .....= .2260
10% shrinkage of cloth.....= .0785

Mill cost (per yard)..... $ .7850

In carding, ordinary care should produce a roving that will give excellent results on the mules, both in quality and quantity of production. The roving should be made about two-thirds draft for both warp and filling, spun to one run. Much greater production will be possible in the weave room if

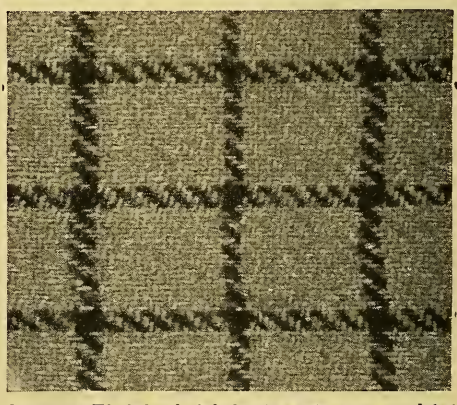
a warp compressor is used in beaming from the dresser reel, and the filling is used in cop form. Burling and sewing are minor items, as the finish will not permit slight imperfections to show on the finished goods. The fulling will require the use of a full-bodied, long-lived soap, as the nature of the stock used will prevent rapid felting. It will probably be necessary to make a fulling soap of half palm oil and half tallow chips, built up with alkali to a strength that will readily saponify the grease content of the pieces. The goods should be run long enough to thoroughly absorb the soap before the traps are let down, as there is a possibility of overshrinking in length before they have come to the desired width. Full to 56 inches in width with 10 per cent shrinkage in length. This should produce a fabric that will be boardy, yet pliable, and one that will tailor nicely. To cleanse the goods thoroughly they should have 30 to 40 minutes' treatment in the washer with warm water, then a rinsing, and another scouring in warm water with fresh soap, followed by a final rinsing in cold water. Extract and give a run or two on the napper in both directions to secure a good cover. Dry, shear off the long hairs, brush, spray and press. Some of our best finishers are of the opinion that a better finish may be obtained by giving the pieces a few runs on the

Napper Before Fulling,

which is possibly true. The effect desired is not a straight, well-laid nap, but simply a felt that will obscure the weave. Napping before fulling raises the fibres, which are subsequently well-felted, into the face in a tangled mass by the action of the fulling mill. The weave here given is not used at all times, some of the higher-grade friezes being woven on the double-plain system.

CARRIAGE ROBES

These cloths, as the name implies, are used for carriage robes, blankets and coverings. A very important feature of fabrics for such use is fastness of color, as they are usually subject to very severe usage, ex-



14 Ounces Finished, 54 Inches Between Listing.

posure to sunlight, rain and all kinds of weather conditions. Strength is also a feature that must be considered in selecting the stocks and manufacturing the yarns. The sample selected for analysis is one of the

cheaper grades, made from a mixture of wool, garnetted hard ends and waste. The better grades are usually composed of a mixture of wool and garnetted waste or entirely of wool. In the example at hand it would be well to give the mixture at least three runs through the mixing picker to secure a thoroughly homogeneous blend. The carding of a mixture such as this is an operation requiring the attention of a skilled overseer. Many mills engage their overseers on the principle that a cheap man is good enough for low stock, while in actual fact it requires skill of no mean order to make a good thread from inferior materials. Another great mistake that is very frequently made is to require the carder to use card clothing that is worn out and totally unfit for use, making for excuse the plea that the coarse stock does not require the carding that would be necessary for fine yarns.

While there is an element of truth in this contention, it is nevertheless a fact that it is impossible to secure the best results with inferior tools. If the carder is expected to deliver to the spinning room roving that shall be capable of being spun into a sound, even thread,

It is Absolutely Necessary

that he be given card clothing that will perform the functions for which it is intended. Many of us have gone into the card room and found workers, strippers and cylinders with spots as large as the palm entirely denuded of clothing, to be met with the rather shamefaced statement that "they are only used on low-grade yarns." It surely needed no explanation to assure anyone that yarns made on such machinery would be low grade in more than one sense of the word. For the stock mixture used in our type of fabric it will not be necessary to use the regular quantity of oil (four quarts to the hundred), in the picker room, as the garnetted hard ends have received a considerable quantity of oil before the garnetting operation. The emulsion may be made up with two parts of water and one of oil as usual, but instead of the customary twelve quarts of emulsion to the hundred, use but eight, and apply the mixture to the wool. This may readily be accomplished by laying out the batch in this manner. A layer of garnetted waste, a layer of card waste and a layer of wool, making as many layers as may be necessary to put up the batch in the space at hand, and applying the emulsion to each layer of wool in as nearly equal portions as is possible. In the case at hand, in order to secure a thorough mixing of the small percentage of waste, it might be well to mix this with the wool and give a run through the picker before adding the garnetted stock. The carder must use good judgment in setting the various parts of the carding machines, and may find it necessary to change his speeds somewhat if the cards have been running on a finer grade of all-wool stock. One of the vital features of carding is the delivery of the greatest possible weight of well-made roving from each lot, and in order to accomplish this a good

Knowledge of Stocks is Essential,

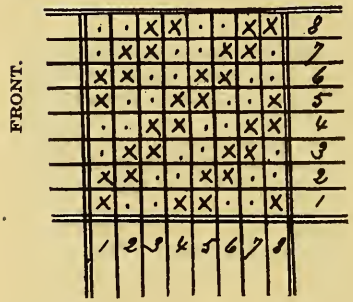
and their action in the cards is a very important part of the carder's equipment. One of the common causes of nonsuccess in woolen manufacture in the past, and, sad to relate, not entirely unknown at the present day, was the excessive waste made in the various departments, particularly in the card room. It is obvious to anyone that if the manager bases his yarn costs on an estimated production of 90 per cent of yarn from each lot, while the actual results show only 80 per cent or less, the calculated profits are very materially reduced, and if the same percentage of difference between estimates and results prevail in other departments, the balance sheet will show a very substantial loss instead of the moderate profit assured by the estimates. It cannot be too strongly emphasized that attention to details of this kind are absolutely necessary, if any measure of success is to crown the efforts of the management. The roving should be slightly over half-

draft for the mules, and if well carded, will give excellent production as well as a round, strong thread. The twist may be a little more than normal for the size, as softness of fabric is not the aim. The dressing may be done on a dry frame, the yarns being of a size and strength that will insure

Practically Perfect Weaving

without the use of size. Burling and sewing should be practically negligible items on fabrics of this sort, as they should come from the looms with a minimum of imperfections.

The fulling should not require much time, as it is not desired to felt the goods to any great extent, but to bring them out with a rather open, lofty finish. The majority of finishers prefer to full these fabrics in the grease, a saving of considerable time, and a method of procedure that should give very satisfactory results. When fulled to the desired width, wash, dry and give only sufficient shearing to even up the nap, then brush and press.



DRESSED AND WOVEN.

4 blue.
20 white.
4 orange.
20 white.

48

Layout:
2,160 ends. 38 picks.
Reed: 8—4—67.50 inches between the listing.

Warp:
2,160 thr., 3¼ run..... = 6.65 oz.

Filling:
38 picks, 3¾ run..... = 7.05 oz.
2 inches for listing.
13.70 oz.
Loom shrinkage, 10%..... 1.37 "
Loom weight .....15.07 oz.

COST CALCULATION.

Material:
50% med. grade wool @ 40c. lb. .. = $ .2000
40% med. grade garnet @ 20c. lb. = .0800
10% med. grade wh. waste @ 12c. lb.= .0120
16)$ .2920
An ounce .....$ .01823

Cost:
15.07 plus 15% .... = $ .3163
17.33 oz. @ 1.70c.
Manufacturing: 38 picks.....= $ .2830
Mill cost, a yard ..... $ .5993

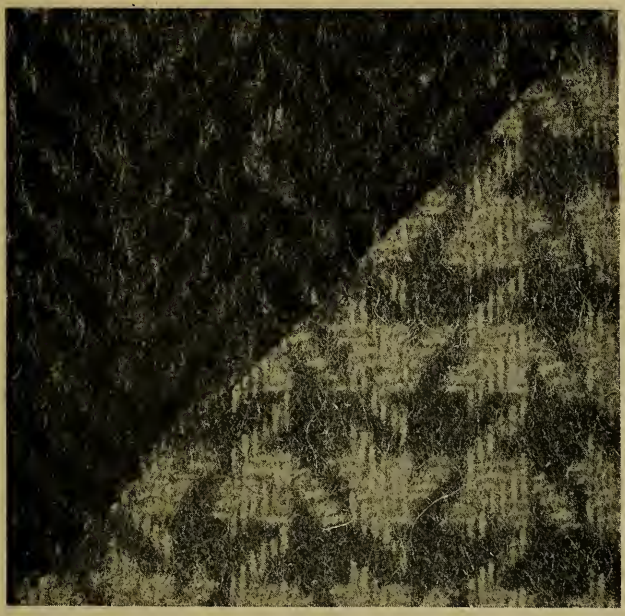
HEAVY-WEIGHT AUTOMOBILE CLOAKING

The constantly increasing use of the automobile as an all-the-year-round mode of conveyance has been the cause of no little activity in the carded woolen industry. During the extremely severe weather fur coats are very largely worn, but by many auto enthusiasts the use of a heavy woolen garment is preferred. The most popular fabric for garments of this character is the heavy, fancy-backed cloaking similar in construction to the type of sample here described and illustrated. Many of our woolen mills have operated their entire equipment in the production of these cloths for some time, and have found them to be very satisfactory profit makers. The wools used in many of these fabrics have been of extremely low grades, and would be classed as carpet wools by those who have been accustomed to work on

the finer grades of men's wear woolens. Cloths similar to that illustrated are usually produced from foreign wools, such as Jorias and Chinas, the latter being particularly adapted for the manufacture of many styles in which the large percentage of kemp to be found in these wools gives an appearance which is well-nigh impossible to duplicate by the use of any other stock. As stated in the article on double-faced cloakings, it is customary to so

Unite the Back and Face

fabrics in weaving that they may be readily separated by the garment maker if he so desires. This is accomplished by the use of an extra binder warp,



29-Ounce Automobile Cloaking.

which has no other function than that of uniting the two cloths. Were this omitted and the weaving carried on in exactly the same manner, the result would be two pieces of cloth, each perfect, and entirely separate from one another. It may be asked why it is not customary to weave fabrics in this manner, as it would appear that weaving two pieces of cloth at one time on the same loom would make a considerable, saving over the method now in use. The fallacy of this reasoning becomes readily apparent when we consider that, although the two fabrics are woven at the same instant, the time necessary to produce them on one loom is no less, and in actual practice probably more than would be required to weave them on two looms. The further possibility of a greater number of imperfections, owing to the fact that the operative could see but one of the cloths, would also militate very strongly against such procedure.

The agitation relative to the use of cotton in woolen fabrics has been carried to such an extent that many garment manufacturers refuse to buy

any cloths containing this extremely useful fibre. The aim of these misguided enthusiasts is very laudable, the prevention of misrepresentation and

Improvement of Textiles,

but the results of their propaganda has been in many instances the direct opposite. As before stated, the function of the cotton binder warp is simply to stitch the back and face cloth together, showing neither on face nor back of the fabric. The use of a cotton thread for this purpose in no way depreciates the value of the cloth as an article of apparel and serves its purpose as well, or even better, than a woolen or worsted thread, yet buyers would condemn it as containing cotton. For that reason, the greater part of the plaid backs are stitched with a worsted binder.

In the manufacture of these fabrics, the wool to be used for the white yarns should be bleached, and also the white in the mixture. For the bleaching, select stock that is of good color, free from stains and yellow tips. The method to be used in the bleaching will depend to a great extent on the facilities at hand. In the ordinary woolen mill it is extremely probable that no special apparatus will be found, and in that case a

Clean Dye-Kettle

may be used. The bath may be prepared with 4 gallons of sodium bisulphite, 71-77 degrees Twaddell, or 21½ pounds sodium bisulphite and 3 gallons of water, 2½ pints sulphuric acid and 500 gallons of water. The wool must be thoroughly washed before entering the bleaching bath. Work well, so as to secure perfect penetration of the entire mass, and allow it to remain in the liquor overnight if possible. Draw off, extract and dry. This method will give excellent results, leaving the wool in A1 condition for subsequent operations.

Care must be taken in the preparatory processes or results in the carding and spinning rooms will be far from satisfactory. The roving must come from the card room clear and free from twits, thus enabling the spinner to produce a round, even thread. The twist in spinning should be slightly under rather than over normal, as the desired result is a soft, full thread. This does not imply, however, that the twist should be so reduced as to affect adversely the weaving qualities of the yarn. A very decided aid in the weave room, when using coarse yarns for filling, is the use of cop shuttles, which permit of placing a much larger supply of filling in each shuttle than is possible when the ordinary type of spindle shuttle is used and the filling woven direct from the mule bobbins. It will also be found advantageous to build the warp chain reversed, that is, risers for sinkers and vice versa, throwing the back of the cloth on the top while weaving, so that imperfections may be more readily seen and remedied by the weaver. It will be noticed that the fabric is laid much narrower in the loom than is customary with the majority of wool goods, but as explained in a former article, this has for its object the prevention of a very common defect in goods of this character, that is, the showing of the back pattern on the face of the fabric. When burled and sewed, full in the grease, using a pure, full-bodied soap with sufficient alkali to freely saponify the grease and maintain its vitality through the fulling and scouring processes. With a soap of sufficient detergent properties, there should be no necessity for an additional supply during the scouring, but should there be any doubt as to the

Thorough Cleansing of the Pieces,

they should be well rinsed and new soap be added with warm water. No napping will be required. The pieces should be extracted and dried, with no unnecessary delay, after leaving the washer. The dry finishing consists merely of a light shearing, brushing, a run on the dewing machine and pressing. The final examination should be in charge of thoroughly competent help, and any defects due to carelessness in the various departments

called to the attention of the proper authorities, so that they may be prevented in the future.

Manufacturing Particulars.

Dressing:

Light face	1 . . .	1 . . .	1 . . .	1 . . .	12	1,008	6.72 ounce.
Dark back	. 1 . .	. 1 . .	. . . .	. . 1 .	6	504	3.36 "
Light back	. . . .	. . . .	. 1 . .	. . . .	6	504	3.36 "
Cotton binder	. . 1 .	. . . .	. . . 1	. . . .	2	168	0.32 "
	3 times.	3 times.	3 times.	3 times.	26 X 84 =	2,184	13.76 ounce.

Woven:

Dark mix face........	1 . .	1 . .	12	1,176	7.84 ounce.
Dark back	. 1 .	. . .	6	588	3.92 "
Light back	. . .	. . 1	6	588	3.92 "
	6 times.	6 times.	24	2,352	15.68 ounce.

Layout:
2,184 ends, 34 picks.
Reed: 7½—4, 5, 4 = 67.20" between listing.

Warp:
2,016 thr., 1½ run.................. = 13.44 oz.
168 thr., 2/20 cotton.............. = 00.32 "

Filling:
34 picks, 1½ run.................. = 15.68 "
Allow 2 inches for listing.

29.44 oz.
10% loom shrinkage.............. 2.94 "

Loom weight .... 32.38 oz.

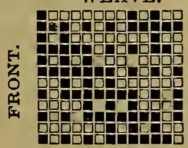
COST CALCULATION.

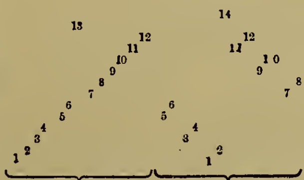
Material:
75% coarse grade wool @ 32c...... = $ .2400
25% coarse grade shoddy @ 14c.... = $ .0350
16) $ .2750
An ounce ....$ .0172
Wool: 32.03 plus 15%.............. = 36.86 oz.
Cotton: 00.35 plus 15%............. = 00.40 "
Cost:
36.83 ounce wool @ 1.72c.............. = $ .6334
00.40 ounce cotton @ 1c............. = .0040
Manufacturing:
34 picks .... = .2670
Mill cost, a yard..................... $ .9044

FULL DRAFT.

2 times. 2 times.

WEAVE. DRAW.

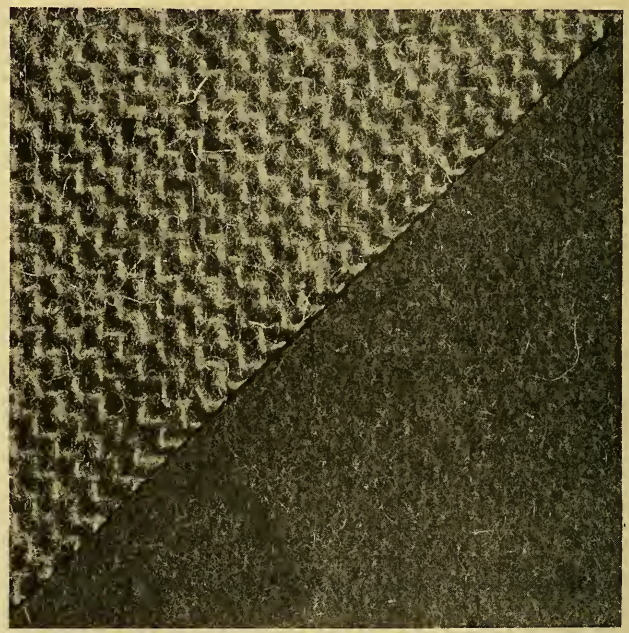




2 times. 2 times.

LADIES' DOUBLE-FACE CLOAKING

The popularity of the coarse twilled fabrics similar to that here illustrated is apparently on the wane for the moment, the vogue at the present time tending very strongly toward the imitation fur and bouclé effects. It is not at all probable, however, that such fabrics will entirely take the place of the twilled coating for any extended period. The richness of coloring, the tasteful mixes which so enhance the beauty of any garment,



20-Ounce Ladies' Cloaking.

particularly those intended for women's wear, can only be developed in fabrics which do not primarily rely on looped effects to give them character and distinction. One of the most pleasing effects in this type of fabric, is developed by means of using two strongly contrasting colors in both warp and filling, for the face, with either a plain or a fancy back. The back may be of colors which blend with the face or may be a decided contrast, but due care must be observed not to use shades which will offend the eye. The object in making

Double-Faced Fabrics

is primarily to obtain a cloth of considerable weight and warmth that shall have the appearance of a lined garment when made up. The relatively lower cost of making up a coat from a fabric of this type and that of producing a coat from two cloths, the shell and the lining, is apparent to anyone and need not be commented on at this time. An objection to many

of the double-faced fabrics produced in former times was the fact that back and face were so thoroughly united in the weaving as to render it a matter of difficulty to separate them for the purpose of turning the lapels and pocket trimmings, while if the cloth was used without splitting the effect was very clumsy and unsatisfactory.

Another difficulty frequently encountered, particularly in the manufacture of fabrics with strongly emphasized color patterns on the back, was that the fancy effect on the back not infrequently was quite

Distinctly Visible on the Face.

It is extremely probable that some of our readers have had experiences of this sort, and if they are finishers or dyers they will no doubt remember very well what efforts each made to assure the superintendent that the trouble did not originate in his department. It is not at all improbable that both were absolutely right in their assertions of innocence, as in many instances, when traced to its real cause, it would be found that the source of the difficulty lay in the stocks used. In many cases the dyer would be accused of putting along colors that were not fast, or the finisher would be taken to task for giving the pieces improper treatment either in the fulling mills or washer, while, in fact, each was obtaining the best possible results from the materials at hand. The cause of the trouble was not that the face of the fabric was stained by dyestuff from the back, but that the proper selection of stock was not used for the two cloths. Imperfections of this sort are much more likely to occur when making goods with a fine face and relatively coarser stock for the back. If the goods are laid wide in the loom so as to require considerable fulling to bring them to the required width, the coarse fibres from the back will frequently work into or through the face fabric, giving the appearance of a stain or print. This may be overcome by

Changing the Construction

somewhat so as to require less fulling, or by using stocks for both face and back which have practically the same felting properties. In the sample analyzed, the stock mixture averages 75 per cent medium wool and 25 per cent shoddy, but frequently the colors which it is desired to use will make a considerable change of percentages necessary. This is more particularly the case if the back is a fancy pattern. In figuring the cost of the line it will be necessary to use exceptionally good judgment, as in case the prices are based on the average cost of the mixtures, it may be found that the major part of the orders taken are for the styles containing the most expensive stock. A feature that will need particular attention is evenness of the yarn in both warp and filling. In the style illustrated this may not be so essential, but frequently, the most freely selling styles in the range are those having a

Light Warp and Dark Filling.

These are difficult to produce in any grade, even with the best of machinery equipment, and in the ordinary cassimere mill, where discipline has become somewhat lax and machinery is not in the best of condition, it is not at all unlikely that a larger proportion of seconds will be made than should be tolerated. It will be neccessary to watch the weight of the roving very carefully, keep the tops and bottoms separate, not only in the spinning but also in the weave room. If the carder has not been accustomed to working on the class of stock used in these cloths he may find trouble in keeping

his weights correct, as the top rings are prone to take more than their share of the stock from the cylinder. Then, too, the side ends may become heavy or light, a very frequent cause of uneven yarn. The weave room is often given the credit for producing uneven cloths when the trouble is in the yarn manufacture, though too often the carelessness of the weavers in changing all the shuttles at one time, or in starting up after a pick out, causes a "heavy place" which shows as a dark streak across the piece. Imperfections of this sort are perhaps more

Difficult to Overcome

on goods which take the picks easily than on fabrics which require some force to beat them home. Burling and sewing are not difficult operations on these cloths, as the looseness of the weave permits of removing knots and slugs with comparatively little effort and the relatively coarse, strong yarn weaves with a slight amount of breakage. Fulling is usually done in the grease, and should be accomplished in as short a time as is consistent with good work, there being much less danger of the back showing through on the face. Full to 58 inches and transfer immediately to the washer. Give half an hour's scouring with lukewarm, not hot, water, then rinse thoroughly and dry. The face will require no napping, the back may or may not require such treatment, depending on the type of finish desired. Should a napped finish be required, the raising should be done before the goods are dried, as it may be accomplished while the pieces are wet with greater ease and much less waste of material. Give a light shearing to remove the long hairs, brush and press.

STRAIGHT DRAW.

Warp:

Dark face	1			1
Back		1		1
Light face			1	1
Back				1
				4

Filling:

Dark face	1			1
Back		1		1
Light face			1	1
Back				1
				4

Layout:
2,048 ends, 36 picks.
Reed: 7½—4—68" between listing.

Warp:
1,024 thr., 2¼ run face..... 4.55 oz.
1,024 thr., 2¼ run back..... 4.55 "

Filling:
18 picks, 2¼ run face..... 5.60 "
18 picks, 2¼ run back..... 5.60 "

2 inches for listing. 20.30 oz.
10% shrinkage ..... 2.03 "

Loom weight ..... 22.53 oz.

COST CALCULATION.

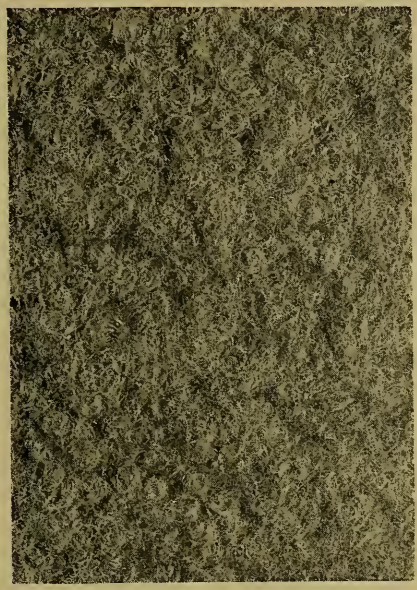
75% med. wool @ 44c	=	$ .3300
25% med. shoddy @ 20c	=	.0500
	16)	$ .3800
		$ .0237

Material:
22.33 plus 15%.
25.07 oz. @ .0237c = $ .6083
36 picks = .2750

Mill cost ..... $ .8833

IMITATIOM ASTRACHAN

The astrachan is a lustrous, curly black fur obtained from the young lambs indigenous to parts of Russia and Persia. Its extreme beauty and high cost has been the cause of many attempts to imitate it in textiles. The inventive genius of the present generation has succeeded so well, that at the present time there are many textile fabrics, knit or woven, that



Imitation Astrachan.

imitate it so closely that a close scrutiny is necessary to determine which is the fur and which the imitation. Many of the closer imitations are woven by means of wires, which raise the luster yarn in loops something after the manner in which Brussels carpets are woven, while others depend entirely on

The Fulling Mill

for the desired effect. The fabric here illustrated and described is of the latter class. The warp is made from a mixture of wool, shoddy and waste and is comparatively inexpensive. The filling, which gives the characteristic appearance to the cloth, is made of a fine grade of mohair. Mohair, sometimes called Angora wool, is the fleece of the Angora goat, a native of western Asia, but now domesticated in many countries. The principal source of supply is Turkey. and from that country comes the finest mohair obtain-

able. For many years past, there have been some large flocks of Angora goats kept in Texas, and these are the source of almost the entire domestic clip. Lack of care, climatic conditions, or possibly lack of attention to breeding may be responsible for the fact that the domestic mohair is not equal to that obtained from abroad.

The peculiarly brilliant luster of the mohair fibre renders it particularly valuable as a material from which fabrics may be constructed in imitation of furs, and modern inventions of appliances for looms and twisters have made it possible to produce fabrics which, in the hands of the skilled finisher, imitate nature very closely. New types of finishing machinery have been developed whereby the peculiar curl to be found in the furs of certain animals are reproduced with an exactness that is truly wonderful. Some years ago mohair was used to a certain extent for the production of linings and dress goods, with a little used in men's wear for decorative purposes, the largest users of the fibre being the manufacturers of

Plushes and Robes.

In the recent past a large quantity has gone into cloakings of various kinds. The warp is prepared in the ordinary way, and dressed dry. The filling is made from a fairly long staple mohair of good grade. Care should be taken in the carding to preserve the length of the staple as much as possible. Do not set closer than is absolutely required to produce a smooth, even roving, which should be a trifle over half draft. Watch the drawing on the mule, changing the draft and weight of roving if necessary until the desired effect is obtained, which is to produce a thread approximating the appearance of worsted as nearly as possible. The mohair yarn should be spooled for twisting, an operation that may be performed either on the ordinary type of ring twister, or, if the spinning equipment will permit, may be accomplished on the mule. If the latter method is used the yarn delivery will need to be approximately full draft. The twist required will be but five or six turns to the inch. The necessity for twisting may be questioned by manufacturers accustomed to using a

Bradford Roving for Filling,

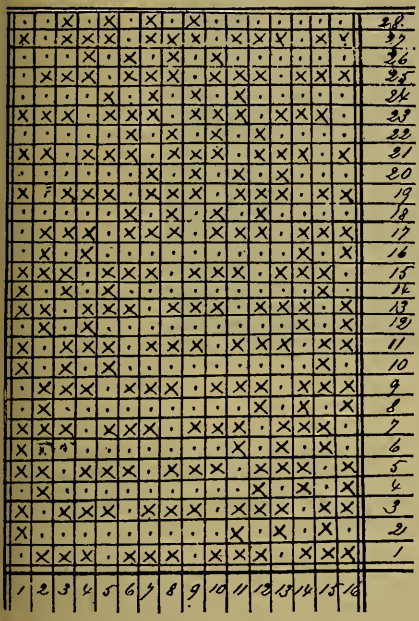
but to one conversant with both types of yarn the advantages of twisting the wool spun thread will be obvious. A single thread made on the woolen system would produce an effect much more in the nature of the so-called "wool plush," while the ply thread will form the loop effect which gives the characteristic finish to astrachans.

In weaving, do not use more tension in the shuttle than is needed to prevent the filling drawing in, as the desired effect is to have the filling form loops on the face of the fabric when finished, and this is aided to a considerable degree if the filling is woven a trifle slack. Burling and sewing are negligible items in the manufacture of astrachans, as the heavy loops on the face of the goods effectually cover up any ordinary imperfections that may occur during the weaving. The most difficult processes connected with the production of such cloths as the one here described are the fulling and dyeing. Unless great care is used in both these processes failure will follow. In making piece-dyed effects the pieces should be scoured and colored before fulling. Avoid crowding either the washer or the dye-kettle, as the drag on the pieces, due to the crowding, may stretch them in length and cause them to become narrow without forming the filling loops which are

characteristic of the fabric. It may be necessary to remove the pot eyes in the washer and to slow up the reel of the dye-tub to get satisfactory results. After coloring they should be well extracted and dried, then put

Through the Soaping Machine

and run into the fulling mills. Examine them from time to time to see that mill wrinkles are not made, a common defect in fabrics of this character, and also to make sure that they are fulling evenly. Full to 56 inches, scour, extract and dry. A light shearing to remove the long hair will put them in condition for the press.



STRAIGHT DRAW.

28 bars, 16 harnesses.
Use straps or extra harnesses for listing.

Warp dressed: Plain black.

Woven: 1 pick wool and 1 pick mohair.

Layout:
1,824 ends, 32 picks.
Reed: 6—4—76" between listing.

Warp:
1,824 thr., 2 run ..... = 9.12 oz.

Filling:
16 picks, 1½ run wool..... = 8.32 oz.
16 picks 3-ply mohair, 1 run.. = 12.48 oz.
29.92 oz.
10% loom shrinkage..... = 2.99 oz.
Loom weight ..... 32.91 oz.

COST CALCULATION.

Material, wool, warp and filling:

50% coarse grade wool @ 36c...= $ .1800
40% coarse grade shoddy @ 16c.= .0640
10% wool waste @ 12c.....= .0120
16) $ .2560

An ounce .....$ .0160
Mohair filling:
Fine grade @56c. = 3½c. an ounce.
Stock:
17 44 + 25% = 21.89 oz. @ $.0160 = $.3488
12.48 + 25% = 15.60 oz. @ $.0350 = .5460
Manufacturing:
32 picks .....= .2590

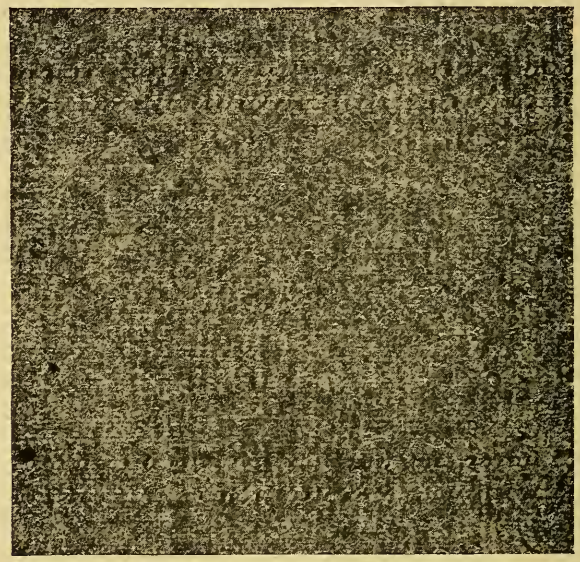
Mill cost $1.1538

WOOL CRASH

The term "crash" as applied to woolen fabrics is a misnomer, as the true crash is cloth manufactured from flax. This designation was applied to a certain type of woolens from a fancied resemblance to the rough, unfinished appearance of the fabric from which it was named. The typical wool crash is a fabric made from rather low-grade wool, the yarns well twisted, with a somewhat rough, harsh handle. The yarns should be even in weight,

but smoothness is not especially to be desired, in fact smooth yarns detract materially from the characteristic appearance of the fabric.

An extremely satisfactory stock mixture for fabrics of this type may be made with a percentage of rather short, nibby silk noils carded with the



Fine 12½ Ounce Crash.

wool, as the roughness of the yarn, due to the imperfect carding of the noil, will assist in giving the desired appearance to the finished fabric. The colorings which have met with the greatest favor at the hands of buyers have been made with mixtures containing the following percentages:

CRASH.—MIXTURES IN DEMAND.

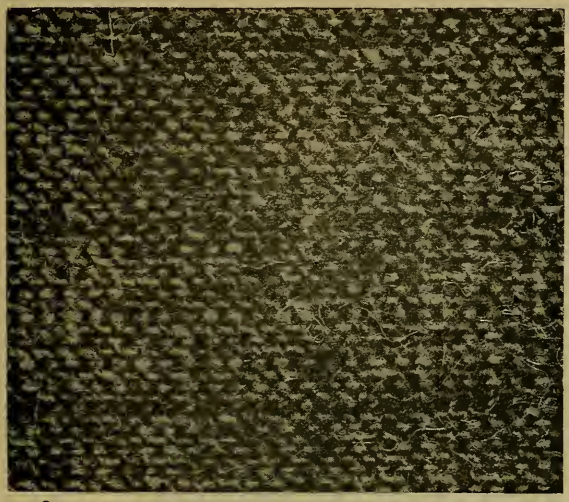
95 0/0 white and 5 0/0 black, brown, blue or tan.
90 0/0 white and 10 0/0 black, brown, blue or tan.
80 0/0 white and 20 0/0 black, brown, blue or tan.
65 0/0 white and 35 0/0 black, brown, blue or tan.
50 0/0 white and 50 0/0 black, brown, blue or tan.
65 0/0 black, brown, blue or tan and 35 0/0 white.
80 0/0 black, brown, blue or tan and 20 0/0 white.
90 0/0 black, brown, blue or tan and 10 0/0 white.
95 0/0 black, brown, blue or tan and 5 0/0 white.

It is important that the stock be thoroughly mixed in the picking, so as to insure evenness of color in the mixture, otherwise the finished fabric will have a decidedly blotchy appearance. Especial care must be taken in the weave room to see that the picks per inch are not varied, particularly on styles requiring the use of light warps and dark filling, as every heavy or light place will be plainly visible in the finished goods, and will necessitate an allowance. The production of this class of fabrics should not be undertaken unless the help have been

Carefully Trained

to keep the picks even, and to make a start up after picking out that will not show in the form of a streak across the cloth. Many overseers of weaving will not attempt to weave warps of this kind except on looms with a positive take-up, claiming that danger of imperfections is very much re-

duced by so doing, while others just as stoutly maintain that a careful weaver can produce better results with the take-up working conditionally. In either case the human equation enters very largely into the results obtained. Burling and sewing should be small items in the production cost of crashes, as the yarns if well made should weave with a minimum of break-



15½-Ounce Crash.

age. More trouble is to be anticipated in the weave room, probably, from knots slipping, owing to the slippery nature of the stock than from actual breakage of the yarn. This difficulty may be very largely overcome by careful attention to the method of tying the ends employed by the spoolers. The fabrics should not be laid wide enough in the loom to

Require Much Fulling,

as to obtain the desired finish the structure of the thread should not be broken up to any extent. The fulling is usually done in the grease, and scouring should immediately follow, no additional soap being required if

DIRECTION OR LAYOUT FOR 12½ OZ. FINISHED CRASH.

1,920 ends, 30 picks per inch.
Reed number: 14-2 in dent—68, 40 inches between listing.

Warp: 1,920 ends, 3¼ run	5.90	ounce
Filling: 30 picks, 3¼ run	6.80	"
	12.70	"
10% loom shrinkage	1.27	"
Equal loom	13.97	"

COST CALCULATION.

13.97 ounce material plus 15% shrinkage.
13.97 ounce.
2.09 "

16.06 ounce material.
Price of wool: 40 cents a pound, or 2½ cents an ounce.

16.06 material @ 2½c	=	$ .4415
Manufacturing: 30 picks	=	.2500
Cost per yard to the mill		$ .6915

STRAIGHT DRAW.

Weave plain on eight-harness to avoid too many heddles on one harness.

that used in fulling has been properly made. Care must be taken, however, to thoroughly remove the dirt, and all traces of soap must be eradicated. After drying, brush, shear and press.

SECOND GRADE OF CRASH.

Made of medium grade of wool, 15 to 16 ounce finished.
1,080 ends, 18 picks; reed 8—2—67½ inches between the list; 6/4 finished.
Warp: 1,080 ends, 1½ run... 7 20/100 ounce
Filling: 18 picks, 1½ run... 8 34/100 "

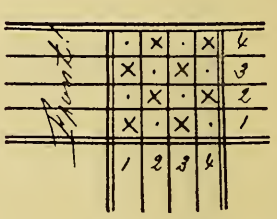
15 55/100 "
10% shrinkage ..... 1 55/100 "

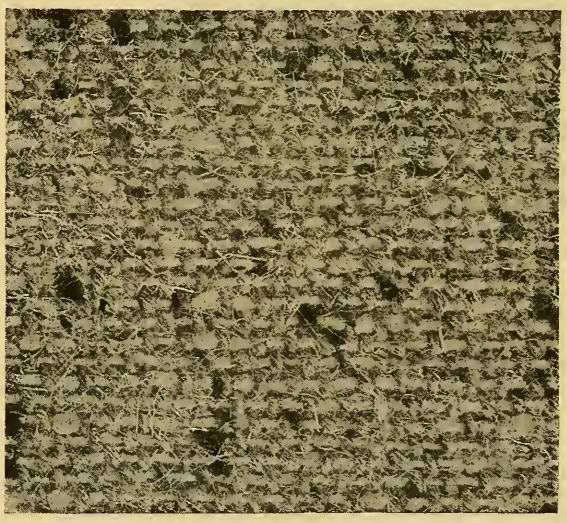
Equal loom weight.....17.1 "

COST CALCULATION.

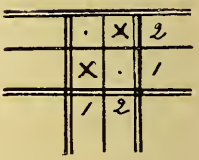
Medium wool: 40c. lb. or 2½c. oz.
Material: 17.1 oz. + 10% shrinkage .....= 18.8 oz.
18.8 oz. @ 2½c. .....= 47c.
Manufacturing: 18 picks.....= 20.3c.

Mill cost ..... 67.3c.
Woven on 4-harness straight draw.





12 Ounce Nub Cloaking Crash.



Design.

THIRD GRADE OF CRASH WITH NUBS.

Lady's spring cloak: 11½ to 12 ounce; use medium grade of wool, and 25% Kandahar.
Warp and filling: ¾ draft hard twist.
600 ends 10 picks reed 8½—1—70" 6-4.

BETWEEN THE LISTING.

Warp: 600 ends 1 run..... 6 ounce
Filling: 10 picks 1 run..... 7.2 "

13.2 "
10% shrinkage ..... 1.3 "

Equal loom weight.....14½ "
Cost: 75% medium wool, 40c... = $ .3000
25% Kandahar, 32c.... = .0800

$ .3800

16)$ .3800($ .02-375/1000
32
60
48
120

Material: 16 ounces @ 2½c.....= $ .400
Manufacturing: 12 picks.....= .135

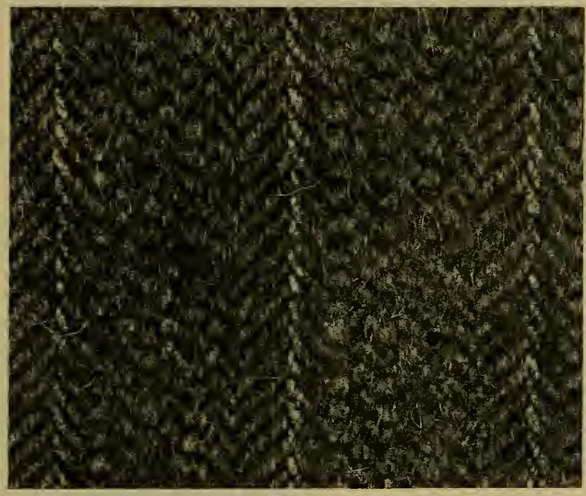
Mill cost ..... $ .535

JUVENILE SUITS AND TROUSERS

There are a number of mills making a specialty of fabrics for the juvenile trade, the styles used for children's suits not being adapted to men's wear, nor are the styles and fabrics in the men's wear line usually such as appeal to makers of clothing for children. In general, it may be said that fabrics for the juvenile trade are made from coarser wools and heavier yarns than the cloths in demand by their elders. The fabrics here described are typical, both in style and construction, meeting with a ready sale and showing a satisfactory profit to the manufacturer. The fabrics are usually of rather low texture, both warp and filling, with but little fulling and finished fairly close. The styles in demand vary from year to year, as do those in other divisions of the market, but there are not the great differ-

FANCY DRAW.

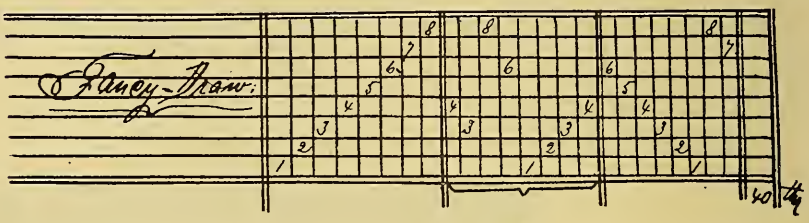
Warp:
In light mixes.
Stripe with silk threads.
Filling:
Dark solid color or mixtures.



12-Ounce Juvenile Suiting.

ences either in style or construction that are to be found in men's wear. They are made in a wide range of colorings, with decorations of various kinds. In recent seasons, stripes of different widths have been popular, one of the most favored decorations being a few threads of silk noil yarn in white or colors. Some time ago the plain mixture effects were leaders, while another season's best sellers may be the so-called "nub crash," a fabric woven with a plain weave from yarns containing wool nubs. The fabrics illustrated are made from a stock mixture of 50 per cent medium-grade wool, 40 per cent medium-grade shoddy and 10 per cent waste. This stock mixture spun to the size required, (3½ run), should produce a strong, smooth yarn that will give an excellent production in the weave room, with satisfactory results in finishing. There is much less opportunity for the designer to display his ability in weave combination on fabrics of this character than would be the case were dress goods the product of the mill. The opportunities offered here are those pertaining to the manipulation of stocks and the tasteful blending of colors in producing a range of mixtures that shall be at the same time harmonious and distinctive. In order to produce colors that

are bright and clear it is absolutely essential that the wools be carefully scoured, free from the natural grease or smut that envelops the fibre in its original state. Unless this is entirely removed in the scouring, subsequent operations are performed with difficulty. The dyer will find it absolutely impossible to secure clear, bright shades on dirty wool, the carding will re-

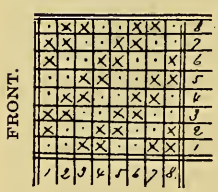


3 times.

sult in twitty yarn, while the cards themselves will be filled with a sticky mass of

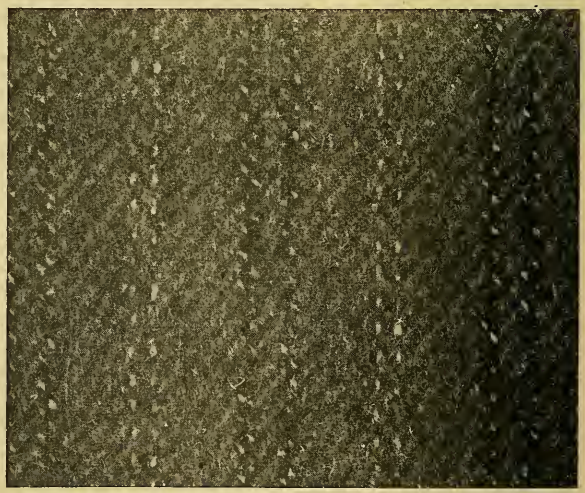
Combined Grease and Short Fibre,

which will make life a burden to the strippers, and cause the overseer to wonder why he ever was so senseless as to learn that particular branch of the business. The great importance of the scouring process seems to be entirely lost sight of, if we are to believe the evidence of our eyes and sense of touch. The scourer, in some instances, seems to think that removing the



FANCY DRAW.

Warp:
Light mixes for stripes with double and twist silk noil and black 12 turns to one inch.



12-Ounce Juvenile Panting.

larger portion of the impurities from the wool is all that is required, and unless watched carefully is apt to slight the work, particularly if the old soaking tub and rinse box are used. Possibly this is not to be wondered at,

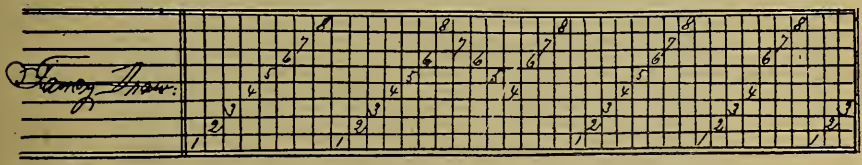
as in many cases the operative is poorly paid, speaks but little English, if any, and has not the slightest idea of the extreme importance of the work in which he is engaged. The temptation to slight the work is not as great in mills where mechanical wool washers are used, but the installation of modern machinery is not all that is required in order to obtain satisfactory results. The detergents used must be pure, and above all, suited to the particular type of wool to be cleansed. The scouring bath that will give excellent results on one grade of wool may be altogether unfitted for use on another grade. The liquor must be changed to conform with the

Requirements of the Stock

to be cleansed. One of the most frequent causes of injury to the stock in the scouring is excessive heat, making the wool harsh and brittle. The scouring bath should under no circumstances be allowed to become warmer than 120 to 130 degrees Fahrenheit, a higher temperature than this being very harmful to the fibre. Drying wool would appear to be an operation so extremely simple that one could not possibly make any mistake there. That great injury may be done the stock during drying has been proven innumerous times in the experience of nearly all mill managers. The best method as yet devised for drying wool is the cold air system. This requires more time and a larger equipment of drying tables than many mills have room for, but the superior results obtained justify the use of the system wherever at all practicable. The installation required consists of racks covered with wire netting to hold the wool, the bottom part boxed in as nearly air-tight as possible and connected with a

Powerful Fan,

which forces air up through the layer of wool on the screen, or exhausts the air from underneath, in this way inducing a current of air down through



the wool. The former method is the most approved, as it leaves the wool in a more lofty, open condition. Fabrics of this type are invariably stock-dyed, as few or practically no juveniles are made in solid colors. The dyer should use discretion in boiling the stock for coloring, as severe boiling felts the stock and makes it both tender and brittle, causing a great amount of waste in subsequent operations, particularly in the carding. See that the stocks are thoroughly blended in the picker room and have sufficient oil to insure thorough lubrication during the carding and spinning. The carding of stock such as is used in the type samples should present no difficulty if the stocks have been carefully handled in the preparatory processes. The roving should be made two-thirds draft, spun right twist, forming a smooth, round thread that will be strong and elastic. No splicing should be allowed in spinning; all broken ends must be tied to insure good weaving. The spoolers should be taught to tie a knot that will not slip on the dresser or in the loom. Production will be greatly increased if attention is paid to these seemingly unimportant details, and much valuable time will be saved in the finishing room. Weaving will be a pleasure with well-made warp and filling, and the looms should easily attain a production equal to 80 per cent of the theoretical possibility. This may seem rather more than should be expected with

warp and filling of the stock and size described, but mill experience in many cases has proven this to be a very conservative estimate. Burling must be well done, the knots carefully raised, slugs and foreign matter removed so far as possible. There should be practically no sewing required, except possibly a broken pick occasionally, as the warp should be strong enough to weave with a minimum of breakage. Run the pieces into the mills two on each side, start the mills and apply the soap

In a Semiliquid State,

just warm enough to flow through a two-inch spout which has been attached to an ordinary watering can. Open the top of the mill and apply the soap just as the pieces enter the rolls. This will secure an even distribution of the soap, if no soaping machine is at hand. These goods require no felt and should be brought out as quickly as possible, placed in the washer without unnecessary delay, and thoroughly scoured with warm water. Half an hour's scouring should float the grease and dirt, so that it may be rinsed out without trouble. Should there be any doubt as to the absolute cleansing of the goods, give another scour with fresh soap, as dirty goods are one of the most unfortunate things that can occur, and usually inexcusable. Extract and dry, shear fairly close, brush, spray and press.

Layout:
4,040 ends, 30 picks.
Reed: 7½—4—68 inches between listing.
Warp:
2,040 thread, 3½ run..... 5.83 oz.
Filling:
30 picks, 3½ run..... 6.00 oz.
Allow 2 inches for listing.
11.83 oz.
10% loom shrinkage..... 1.18 oz.
Equal loom weight.....13.01 oz.

COST CALCULATION.

50% medium grade wool @ 44c.....	=	$ .2200
40% medium grade shoddy @ 20c....	=	.0800
10% medium grade wool waste @ 12c.	=	.0120
	16)	$ .3120
An ounce		$ .0195
Material:		
13.01 plus 15%.		
14.96 ozs. @ 1.95c.....	=	$ .2917
Manufacturing:		
30 picks	=	.2500
Mill cost, a yard		$ .5417

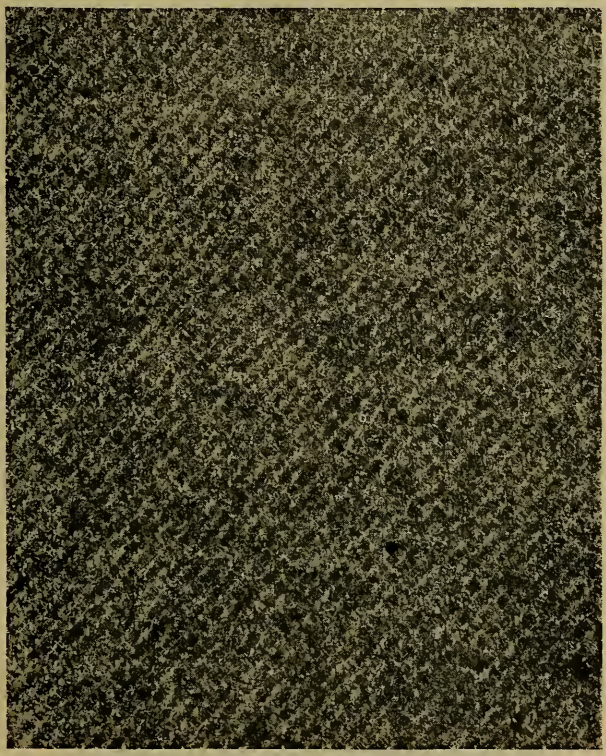
HOMESPUN

Fabrics of this kind are usually made from a medium grade of wool, to imitate as closely as possible the product of the old spinning wheel and hand loom. The wools from which these are made should be of fairly long staple, thoroughly scoured, and free from all vegetable matter. In the card room it may be necessary for the carder to change his speed and to vary the setting of the various parts of the card, and in this way he will be able to imitate quite closely the rough thread as spun by hand. The roving should be made so as to allow half draft on the mule, which will give a strong round thread, insuring excellent results in the weave room in the way of production, with a minimum of work in the sewing department. Many of the most popular of these cloths are made with a white warp and a dark filling, which is an extremely difficult pattern to produce perfectly. Every effort should be made to see that the beams are perfectly true, that the whip roll revolves easily in its sockets, and that the take-up is in perfect working order. Many loom fixers are of the opinion that better results can be obtain-

ed by the use of the old-style conditional take-up on work of this kind, but in most cases it will be found that the use of the positive take-up either of the ratchet ring or the worm gear type will

Produce Better Results.

When the warp is ready to be put in the loom, new friction bands should be placed on the beam heads, which have been well sprinkled with powdered graphite. Attention to these details will do much toward producing perfect cloth. Burling and sewing on fabrics of this kind should be very inexpensive



10-Ounce Homespun.

items. With well-made yarns the warp should run practically day in and day out, without any breaking. From the sewing room the goods should be taken to the wet finishing.

On goods of this type and weight it is absolutely essential that a soaping machine should be used. Without this, it is practically impossible to secure an even distribution of the soap, and unless every part of the piece is soaped evenly, uneven fulling will be the result. Full to 54 inches, which should not take more than 30 minutes, transfer immediately to washer, scour

thoroughly, and dry as soon as possible. Brush and shear lightly, simply removing the long hairs, give a light steaming, and press.

Weave very even so that the twill may show perfectly clear.
Layout:
2,160 ends, 40 picks.
Reed 8—4—68 inches between listing.
Warp:
2,176 thr., 5 run..... = 4.35 oz.
Filling:
40 picks, 5 run..... = 5.52 oz.

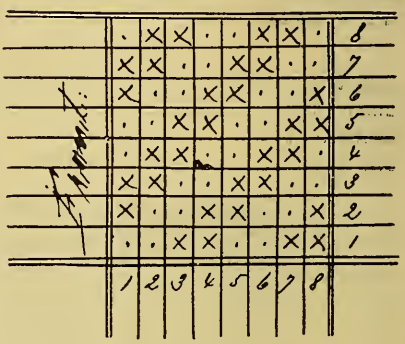
9.87 oz.
10% shrinkage..... .98 oz.

Loom weight.....10.86 oz.

COST CALCULATION.

Medium wool 40 cent = 2½c. oz.
13 ounce material with 15% shrinkage = $ .2121
Manufacturing:
40 picks at 9 mills..... = .36

Mill cost, a yard..... = $ .5721



Full Draft.

14 TO 15 OUNCE HOMESPUN.

2,176 ends, 40 picks, reed 8—4—68 inches between listing.
Warp:
2,160 thr., 3½ run..... 6.20 oz.
Filling:
40 picks, 3½ run..... 7.9 oz.

14.10 oz.
Shrinkage, 10% ..... 1.41 "

Equal loom weight.....15.51 oz.

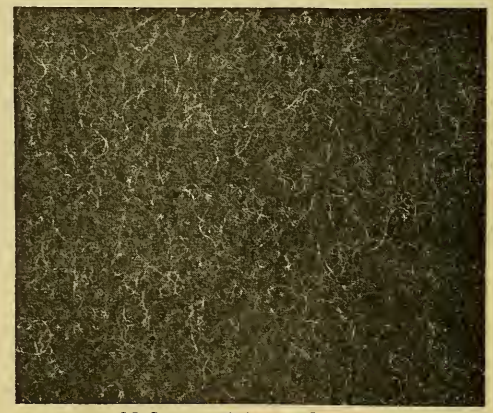
COST.

40 @ 1b. medium wool = 2½c.
15% shrinkage = 1,783 oz. @ 2½c. = $ .4457
Manufacturing:
40 picks .....= .2910

Mill cost, a yard..... $ .7367

ULSTER OR OVERCOATING CLOTH

The fabric here illustrated is made from medium grades of wool and shoddy and finished with a considerable nap, which is well brushed and laid

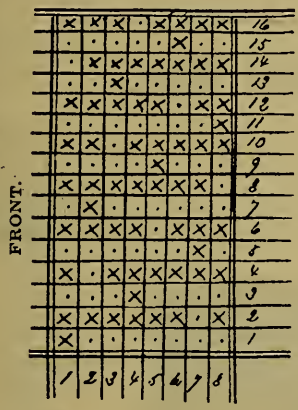


32-Ounce Ulster Cloth.

straight, resembling somewhat a zibeline, but without its luster. The fabric is of relatively low texture, having but 2,400 ends and 48 picks. It is con-

structed with an extremely loose weave, an eight harness filling plush satin, both face and back. In order to obtain the best results, it is necessary that the stock should be carefully mixed at the picker and well carded. The roving may be made two-thirds draft, insuring the production of a full, round and elastic thread. Warp should be twisted to the right, and the filling spun left twist. Fabrics of this type are usually woven in the grey for piece-dyeing, or in a variety of mixtures. If the mixtures are to be black and white, the white should be bleached, which is an extremely simple process, and may be carried on without the use of any special apparatus. The method in general use in fancy cassimere mills is to use a clean dye-tub filled with clean, cold water. The bleaching bath is made up of 60 pounds bisulphite of soda and 10 pounds oil of vitriol. Put 300 pounds of wool in the tub and let it stand all night. In the morning draw off the tub, extract and dry the wool, and it is ready for use.

In making mixtures containing a small percentage of the white it may



STRAIGHT DRAW.

Weave:
Eight harness.
Doskin weave. (Filling).

Warp and Filling:
In solid colors, as black, blue, brown and in all kinds of mixes. If white wool is used bleach same according to instructions given below.

Layout:
2,400 ends, 48 picks.
Reed: 8—4—75" between listing.

Warp:
2,400 thr., 2¼ run ..... 10.66 oz.

Filling:
48 picks, 1¾ run ..... 21.10 oz.

31.76 oz.
Loom take-up, 10% ..... 3.17 oz.

Loom weight ..... 34.93 oz.

COST CALCULATION.

Material:

60% med. grade wool @ 44c.....	=	$ .2640
20% med. grade shoddy @ 18c.....	=	.0360
20% med. grade wool waste @ 10c..	=	.0200
	16)	$ .3200
An ounce		$ .0200
34.93 oz. plus 15% shrinkage.....		
5.23 oz.		
40.16 oz. @ 2c.	=	$ .8032

Manufacturing:

48 picks	=	.3240
5% cloth shrinkage.....	=	.0600
Mill cost		$1.1872

be found beneficial to mix an equal quantity of black with the white and run this through the mixing picker first, then add this mixture of black and white in proper proportions to the balance of the batch. In this way a much more even mix can be secured. Mixtures containing less than 20 per cent of any given color should have at least three runs through the mixing picker or the resulting mixture is very liable to appear blotchy in the goods.

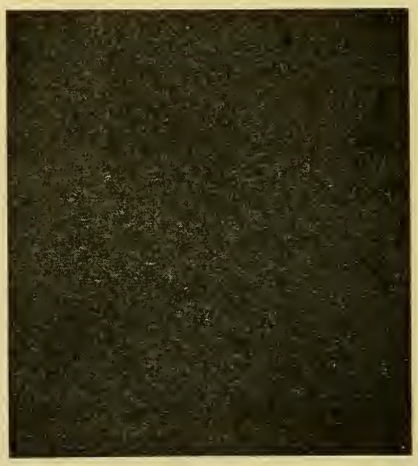
Warps May Be Dressed on a Dry Frame,

as no size will be needed. The size of the yarn and the few interlacings of

the weave will easily stand any strain that will normally be placed on it. The burlers should be instructed to raise all knots and clip the ends off, leaving them sufficiently long, so that during fulling they will not draw back into the goods and leave pin holes. There should be practically no sewing on a fabric of this kind. For fulling use a full-bodied, pure palm oil soap, fortified with sufficient alkali to thoroughly saponify the grease contained in the goods. Full as quickly as possible, and do not attempt to secure much felt. Scour thoroughly, extract and place on the napper. If a wire napper is used, this operation will take only a very short time, but if the operation is performed on the old-style teasel gig it will require six to ten runs to get the desired amount of nap. After napping, give three or four runs on the wet brush, extract and dry. Shear off only the long hairs and give a light pressing.

RUSSIAN TWILL DRESS GOODS

Twill dress goods are usually made from a fine grade of wool, woven in the white and piece-dyed into the various shades, as taste and fashion demand. The yarn is spun, both warp and filling, right twist, the goods are finished with no endwise shrinking, and are sheared out clean so as to show the twill. Very satisfactory fabrics of this type may be made from either pulled or shorn wools. The fabric here described was made from a nice half-blood



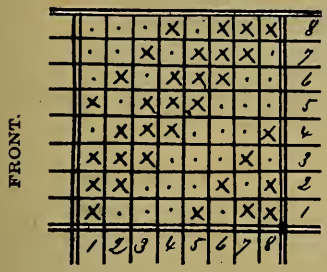
8-Ounce Dress Goods.

territory. The wool should be carefully sorted, all paint and burs clipped out, and scoured with a pure potash soap. When dry, the wool may be taken to the picker house, given 12 quarts of an emulsion made up of two pails of water to one pail of oil and saponified with borax or some other mild

alkali. One run through the mixing picker should be sufficient. The cards must be in No. 1 condition, set rather closely and kept thoroughly clean. The roving should be made half draft, which

Will Insure a Good Production

from the cards and enable the spinner to produce a smooth, round, strong thread. On yarns as fine as used in this fabric it will be advisable to use a fairly heavy size. Many mill managers will take exceptions to this method of procedure. An experience of many years on a variety of goods has convinced the writer that it is possible to secure a much greater production from the weave room if warps are sized when the yarns are finer than 5½ run. It not only insures better running work in the weave room but also eliminates much of the sewing due to broken threads. Full to 56 inches and transfer immediately to the washers. When thoroughly clean, the goods may be taken to the dyehouse without extracting or drying. Dyeing is carried on in the ordinary form of piece-dye kettle in which the goods pass over a reel and are alternately in and out of the dye-liquor. When the correct shade has been attained, cool off the pieces in the tub, rinse, extract and dry. The dry-finishing operation on fabrics of this type is very simple. After a run on the brush, they should be sheared rather closely, given a run on the steam brush and pressed.



DRAFT.

Layout:

3,000 ends, 36 picks $\frac{6}{4}$ = 56" finished.

Reed: 10½—4—71" between listing.

Warp:
3,000 ends, 7 run ..... 4.29 oz.

Filling:
36 picks, 6 run .....4.50 oz.
2" for listing.

8.79 oz.
10% loom shrinkage .....0.87 oz.

Loom weight .....9.66 oz.

COST CALCULATION.

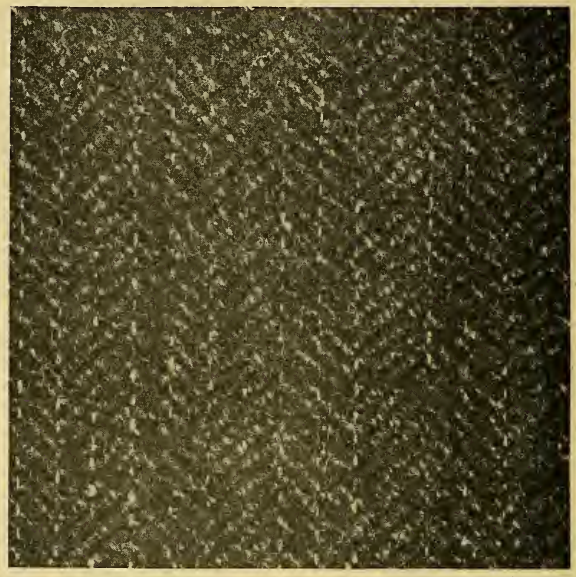
9.66 oz. plus 15% shrinkage = 11.10 oz. fine wool.

Material:
56c. fine grade wool at 3½c. an ounce.
11.10 oz. @ 3½c..... = $ .3885
Manufacturing:
36 picks ..... = $ .2750

Mill cost (per yard)..... $ .6635

TWEEDS

The tweed is said to have received its name as the result of an error in attempting to read the handwriting of an old Scotchman who, as a result of having some tender yarn in the mill, doubled the threads, twisted them, dressed a warp, which he wove in single filling, and sent the finished fabric to his London factor. In his letter he stated that he was sending some tweels, which he hoped might meet with a ready sale. In reading the letter, the sales agent mistook the word tweel for tweed, and advertised the goods extensively as something new. They immediately took the popular fancy, resulting in some very satisfactory orders, and these orders went down to the mill, marked "Scotch Tweeds."



12-Ounce Spring Suiting.

In its construction, the tweed is somewhat similar to a cheviot, being of relatively low texture, and not closely finished. The

Chief Point of Difference

lies in the fact that tweeds are invariably made with a two-ply warp, some-

Layout:
1,728 ends, 34 picks.
Reed 6½—4—66, 46 inches between listing.
Warp:
1,728 thr., 5½ run, double twist..... 6.28 oz.
Filling:
34 picks, 4 run..... 5.80 oz.
12 inches for listing.
12.08 oz.
Loom shrinkage, 10%..... 1.20 oz.
Loom weight .....13.28 oz

Warp:
Double twist, 12 turns to the inch.
Filling:
Plain black with decoration.

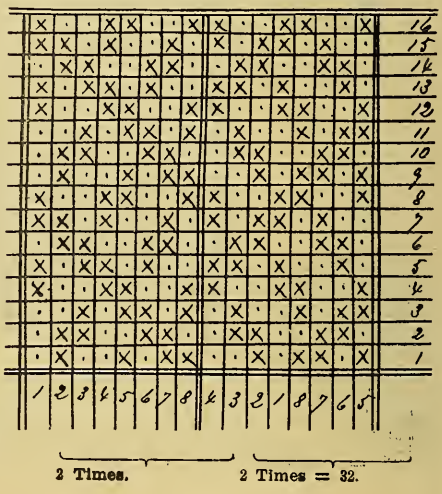
MATERIAL.

50% fine wool @ $ .0056	=	$ .2800
50% med. wool @ .0040	=	.2000
16)		$ .4800
Finished loom length, an oz.		$ .0300

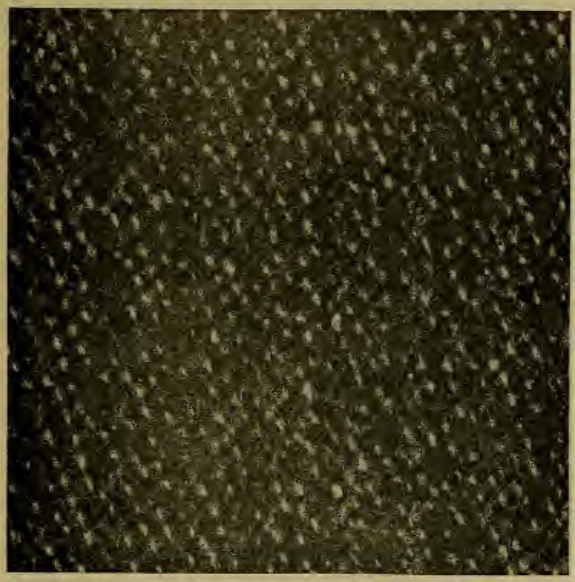
COST CALCULATION.

13.28 ozs. plus 15% = 15.27 ozs. @ 3c.	=	$ .4581
Manufacturing:		
34 picks	=	.2670
For twisting	=	.0500
Mill cost, per yard.....		$ .7751

BROKEN TWILL HERRINGBONE.



times with two-ply filling, but more frequently the filling is single. The majority of these fabrics are made from medium grades of wool, usually of quarter-bloods spun to about four run and doubled with about eight turns



16-Ounce Fall Suiting.

to the inch. The warp yarn should be spun about half draft and made as smooth as possible. Weaving of tweeds should give an excellent production, as the warp yarns are strong and should weave with practically no breaks whatever. The single filling is somewhat heavier than the original thread spun for the warp, but seldom is made as heavy as the resulting warp twist. After burling and sewing, the goods should be fulled for a short time, as no felt is necessary. Scour thoroughly with a full-bodied neutral soap, and rinse well. After drying, place on the steam brush, then shear to what is termed a semifinish. Press hard and give a run on brush before rolling up.

Layout:
1,400 ends, 24 picks.
Reed 10½—2—66, 66 inches between listing.
Warp:
1,400 thr., 3½ run, double twist..... 8.00 oz.
Filling:
24 picks, 2 run..... 8.24 oz.
Two inches for listing.

16.24 oz.
10% for loom shrinkage..... 1.62 oz.

Loom weight .....17.86 oz.

Warp:
Double twist, 8 to 9 turns to the inch.
Filling:
Plain black, with twist decoration.

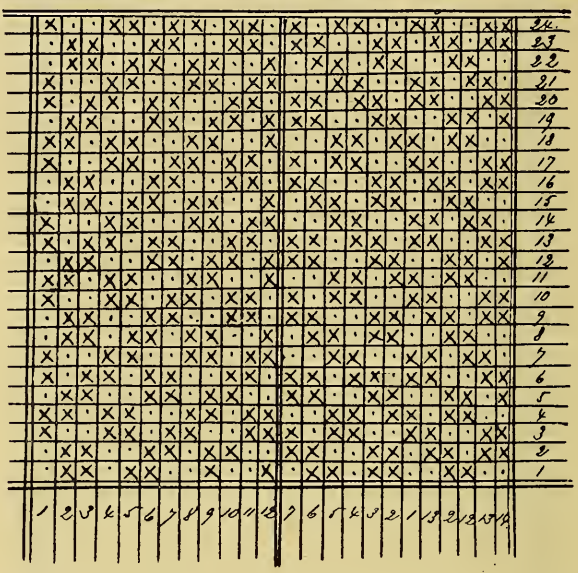
Material:
Medium grade wool @ $ .44 = .0275 an ounce.

COST CALCULATION.

17.86 oz. plus 15% = 20.53 oz. @ $ .0275 = $ .5645
Manufacturing:
24 picks .....= .2260
For twisting .....= .0500

Mill cost, per yard..... $ .8405

COMBINATION: 4 HARNESS TWILL AND BASKET HERRINGBONE.



LADIES' SUITINGS

Fabrics of this type may be made from good A super wools or from an equivalent grade of territories. The use of A super is to be preferred, if the styles in demand are mixtures, as the pulled wools are less inclined to prove specky, and, as a general thing, are freer, making a more homogeneous mixture, free from the blotchy appearance so frequently seen even in high-priced cloths. Care must be observed in the dyeing, so as to prevent felting of the stock, which detracts not a little from its carding and spinning qualities. The preparation of the stock for the card room must be thorough, the oiling and picking being very important processes in the production of any kind of woolens, and especially so when fine yarns are to be made. The amount of oil to be applied to the stock depends somewhat on the

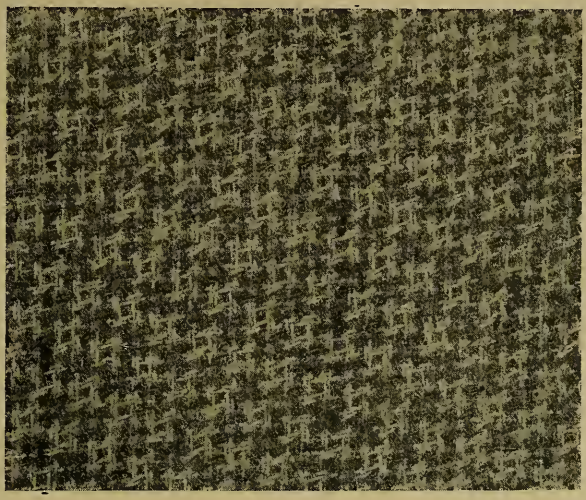
Quality and Condition,

and varies with weather conditions to a certain extent. The cards should be in A1 condition, set fairly close, so as to comb out any pills of short stock in the batch. The roving must be free and clear, well rubbed and made half draft. With roving in good condition, the production of the mules should show a high percentage of efficiency and a strong, smooth thread. During the winter months the carder may experience some difficulty with electricity at the condensers, but there are appliances now obtainable which are claimed to obviate this entirely. If these devices are not to be had, an application of alum water in small quantities in the picker room will do much to eliminate this feature. It should not be applied too freely, as it is

somewhat of a hindrance in the finishing. The yarns should be carefully spooled, with knots tied in such a manner that they will

Not Slip During Dressing

or weaving. Weaving cloth from well-made yarns with the layout given should show a relatively high production of practically perfect cloth. A well-



17½-Ounce Heavy-Weight Cassimere.

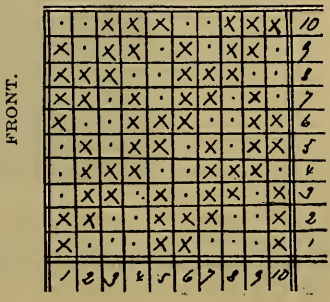
known Connecticut mill, manufacturing a fabric similar to that here described, but with 40 picks of 5½-run filling, operated 30 looms full time for several years with but two girls in the finishing room, who did all the burling, sewing, specking and mending. This record is not beyond the reach of others, if they will pay the same careful attention to selection of stock

STRAIGHT DRAW.

Warp and filling:
2 light, 2 dark, with fancy stripes.

DECLINAL TWILL WEAVE.
Also made plain light warp and dark filling.

STRAIGHT DRAW.
Repeats on five harness.



and yarn manufacture. When burled and sewed, the pieces are put through the soaping machine, even distribution of the soap being absolutely necessary if perfect results are to be obtained in fulling. If no soaping machine is at hand, the pieces may be run into the mill and the soap applied in a semifluid condition as the goods enter the rolls. Full to 56 inches, scour thoroughly, rinse and dry. The goods are not fulled in length but finished loom yards. From the dryer take to the shear, and give sufficient runs to clear them out, brush and press.

Layout:
2,040 ends, 34 picks.
Reed: 7½—4, 68 inches between listing.
Warp:
2,040 thr., 5 run..... 4.08 oz.
Filling:
34 picks, 5 run..... 4.76 oz.
9.04 oz.
Loom shrinkage ..... .90 oz.
Equal loom weight..... 9.94 oz.

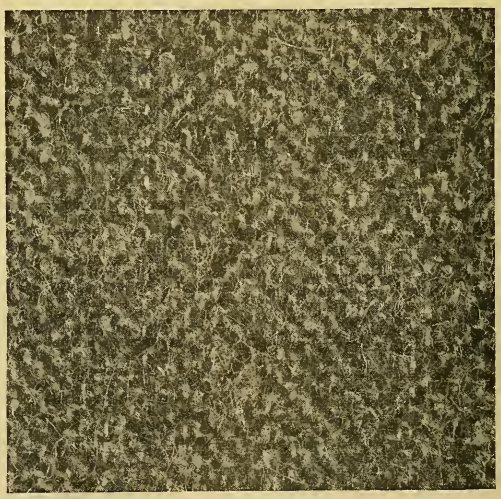
Material:
75% fine wool @ 56c..... = $ .4200
25% medium wool @ 44c..... = .1100
16) $ .5300
$ .0332

COST CALCULATION.

Material:
9.94 ozs. and 15% shrinkage =
11.43 ozs. @ 3.32c.....= $ .3794
Manufacturing:
34 picks .....= .2670
Mill cost, a yard..... $ .6464

HEAVY-WEIGHT CASSIMERE

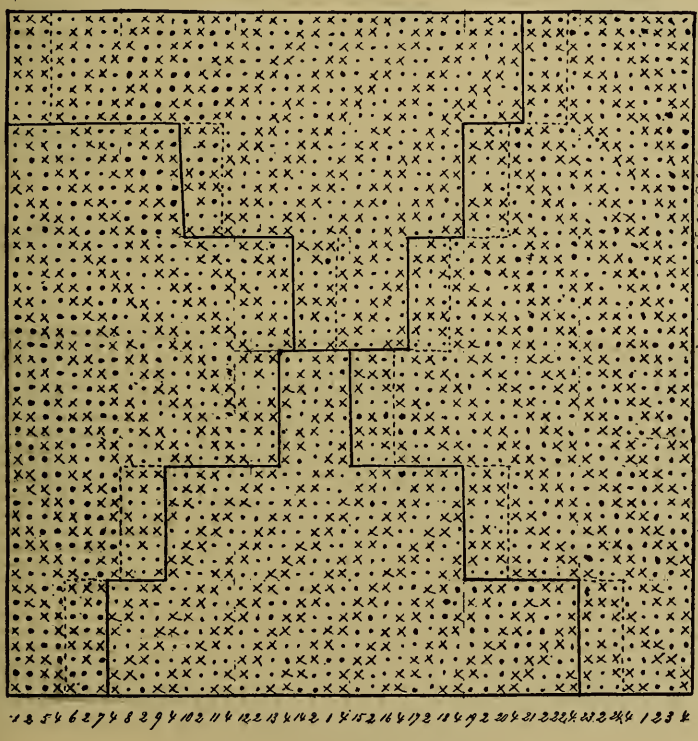
The comparatively low price of worsteds, combined with the fact that it is possible to secure much snappier, clean-cut styles in a worsted fabric



17½-Ounce Heavy-Weight Cassimere.

than can be produced in woolens, has been responsible, in a marked degree, for the lack of interest in cassimeres. While the cassimere will give ex-

cellent service and is a fabric of much more warmth than a worsted of the same weight, popular taste, educated to a great extent by the clothier, has demanded worsteds for suiting purposes. It is only within the last two generations that the worsted fabric has come to the front. Previous to that time there were comparatively few worsted mills in the country, and many of the old-time manufacturers, when asked to make a line of samples from the new yarn, laughed at the idea, thinking it was only a temporary fad. A few, who were more progressive than their neighbors, started the manufacture of worsted yarns and fabrics, making comfortable fortunes for themselves. The relative position of the two branches of the industry is shown by the number of looms devoted to woolens and worsteds in 1869 and in 1909, a period of 40 years intervening. In 1869 there were 34,183 woolen



Full Design Draft.

and 6,126 worsted looms, while in 1909 the woolen looms were but 33,148 and the worsted looms 39,476.

The manufacture of fancy cassimeres requires talent of no mean variety, and offers to the trained mind a field second to none. The knowledge of stocks, necessary to the successful operation of a woolen mill, can only be gained by long years of experience in handling them and careful observa-

tion of the various fibres and their action during the intricate manufacturing processes. There are many who are positive that the success of the mill lies

Entirely with the Designer,

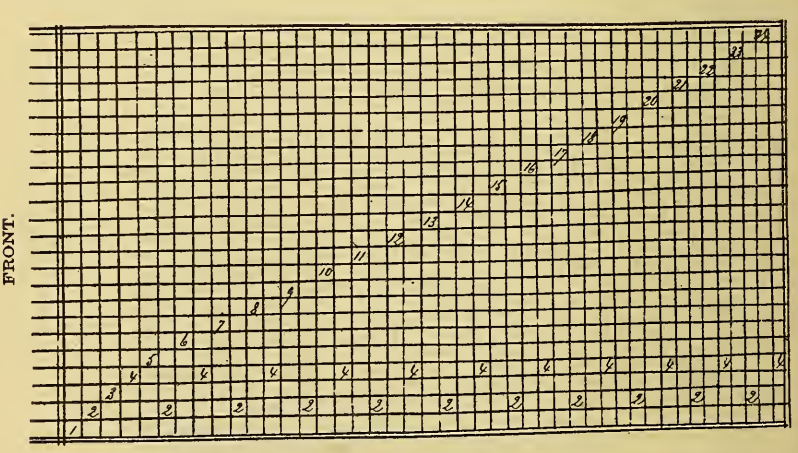
but this is a mistaken idea. Not that we would belittle that extremely important branch of the business, but it must be admitted that the foundation

Layout:	
1,828 ends, 30 picks.	
Reed 9—3—67, 75 inches between listing.	
Warp:	
1,828 thr., 2¼ run	8.12 oz.
Filling:	
30 picks, 2¼ run	9.29 oz.
2 inches for listing	17.41 oz.
Loom shrinkage, 10%	1.74 oz.
Equal loom weight	19.15 oz.

Material:		
50% coarse grade wool @ $ .0036	=	$ .1800
20% medium grade wool @ $ .0040	=	.0880
20% medium grade shoddy @ $ .0020	=	.0400
10% med. grade wool waste @ $ .0012	=	.0120
16)		$ .3200
An ounce		$ .0200
19.15 ozs. stock plus 15% = 22.02 ozs., @ 2c.	=	$ .4404
Manufacturing:		
30 picks	=	.2500
Mill cost, per yard		$ .6904

of the whole manufacturing structure is an intimate knowledge of the stocks required to give the desired effect in the finished fabric. Unless the proper stocks are combined to make the yarn, the efforts of the most skillful designer will not avail to bring out a salable fabric.

One of the most important features of woolen manufacturing, and one that is very frequently neglected, is the mixing and oiling of the stock in



Drawing-in Draft.

the picker house. This operation should be in charge of a man who is absolutely reliable, as an error here may easily prevent the successful production of the fabric. The percentage of the various stocks and colors must be weighed exactly, or it will be practically impossible to duplicate the

style when it becomes necessary to do so. The quantity of oil in the emulsion, and amount of emulsion put on the lots, must be kept uniform, or it will be impossible for the carder to make even roving or for the

Spinner to Produce Even Yarns

from day to day. Such items as these may appear too small to notice, but it is attention to these seeming trivialities that wins success for the mill manager.

The carder should use the greatest care to have the stock well opened and the roving free from twits or heavy places. It has often been said that the card room is the heart of the fancy cassimere mill, and the statement has much of truth in it, for if the stock is not properly carded, it is impossible to make a yarn from the roving that will give satisfactory results in other departments of the mill. The roving should be made heavy enough to permit of half draft on the mules, so as to allow sufficient drawing to straighten out the fibres as much as possible, thus forming a thread of the greatest strength that can be obtained from the stock used. Many times the fact that a warp runs poorly in the loom is attributed to the use of too low a stock when, in a great majority of cases, the trouble lies, not in the stock but in the fact that it has

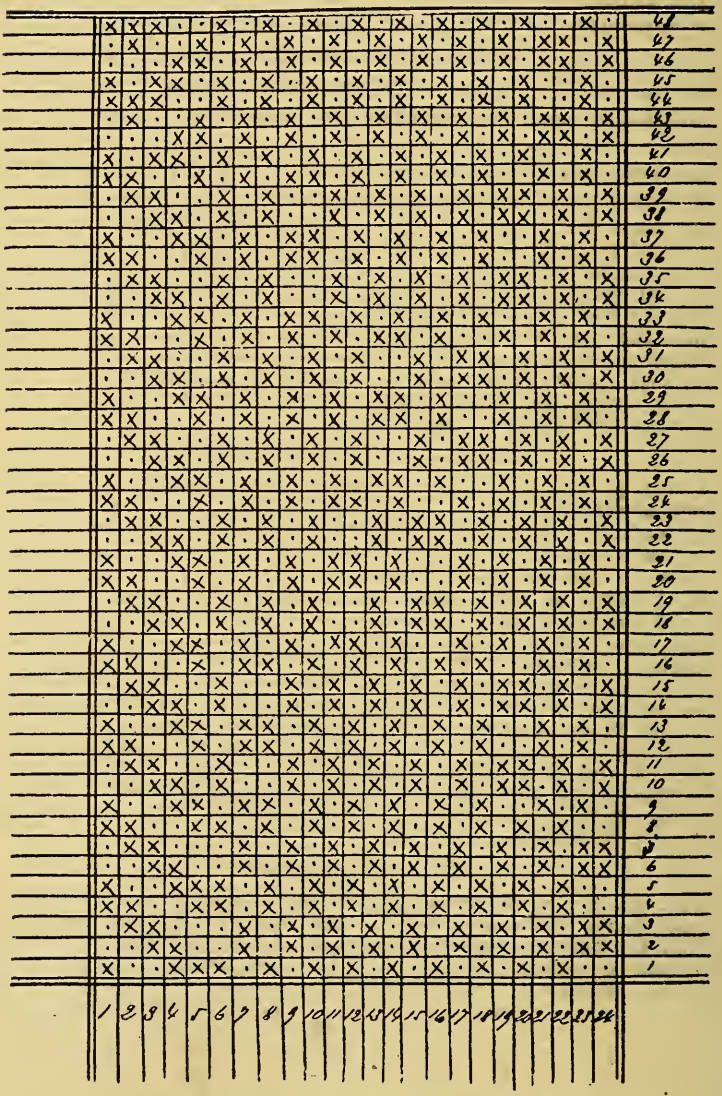
Not Been Intelligently Handled,

and its full possibilities been developed in the spinning room. When the spinner's attention is called to the fact that the yarns are not strong, the usual procedure is to give it another hole of twist or to let it out a hole, the latter process making a heavier thread, and throwing the cost calculations into more or less confusion. Instead of this method of overcoming the trouble, it would be much better in the majority of cases to consult with the carder and see if, by a change in the roving, it would not be feasible to draw the yarn more, securing a greater parallelization of the fibres, and so materially increasing the strength of the thread. To many spinners, the mule seems to be simply a machine for twisting the roving and placing the yarn on bobbins. This is an entirely wrong conception of the machine. As pointed out in the article on wool spinning, the functions of the mule are threefold, drawing, twisting and winding the yarn on bobbins. While the last two are very important, it must be kept in mind that the first is fully as essential to the production of a perfect thread as either of the others. It must be apparent to anyone that the greatest strength of a fibre is in the direction of its length, so that the

More Nearly Straight

the fibres are laid in the thread, the stronger it becomes. Twist is a very important factor in giving strength to the yarn also, but beyond certain limits it has the opposite tendency, making the yarn harsh and brittle. Every spinner has doubtless had proof of the latter statement, and seen ends break down because of "twisting off." Another source of trouble when spinning yarns from a shoddy mixture is the presence of "hard ends" in the stock. These are threads of unusually hard twist, which have resisted the action of the garnett machine or rag picker. As they retain the twist originally given the yarn, it is impossible to draw them on the mule, consequently the end breaks down as the carriage comes out. The style here described requires 24 harnesses for its reproduction, and in getting the loom ready for the weaver, the fixer must use care and judgment to time the various parts of the loom so that each will perform its function with the least possible strain. The weaver should give strict attention to warp and filling, replacing broken ends as soon as discovered, as every thread must be in its

TOP.



FRONT.

Chain Draft, 24 Harness, 48 Bars.

place in the finished fabric. When taken from the looms the pieces should be perched, every imperfection marked, and the cloth measured and weighed. A record of the piece number, loom

number, weaver's name, length and weight of the piece, should be made in a suitable book, and also any details as to imperfections noted. Burling must be thoroughly done, as a knot allowed to remain in the goods is very liable to cause a hole during shearing. Every broken end or pick must be replaced by the sewers, coarse ends removed and a perfect thread substituted, floats and holes repaired, slugs reduced, in fact, the cloth put in as nearly perfect condition as is possible.

Fulling should be done in the grease, the soap used being a pure neutral base, built up with a mild alkali and absolutely without free caustic alkali, as this has an extremely harmful effect on the wool fibre, rendering the goods harsh and wiry. From the fulling mills transfer at once to the washer and scour for 30 to 40 minutes in warm water. Open the gates and rinse well. Should there be the least doubt as to the goods being

Thoroughly Clean,

give another 20 minutes' scouring with fresh soap and warm water, taking care that every trace of soap is rinsed out before the pieces are taken from the washer. Extract and dry before napping. As it is not desired to finish the goods with a nap, but to have them as clear as possible, the object to be obtained on the napper is not to form a nap but simply to raise the fibres so that they may be readily removed by the shear blade. This is much more readily accomplished by running the cloth on the napper dry, as the fibres stand out from the body of the fabric. Much better results will be obtained by shearing slowly, that is by giving several runs instead of lowering the blade and attempting to remove all the nap at the first operation. Clear out the twill so that every individual thread shows distinctly, brush, spray and press. The result will be a fabric of which any finisher might well be proud.

VENETIANS

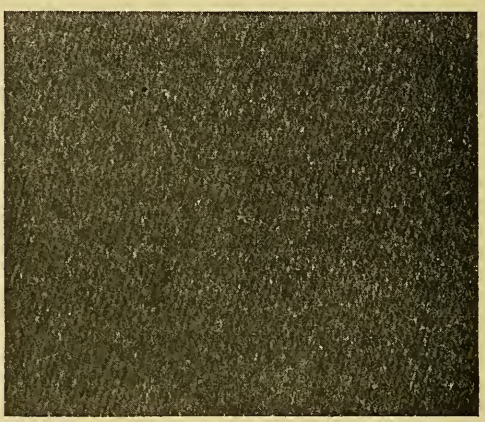
The Venetian is a fine woolen cloth used extensively for spring topcoats, ladies' jackets and in the lighter weights for skirtings. They are frequently made in piece-dyes, but for coating purposes are usually produced in mixtures, and in many instances the mixture Venetians are sold under the name of coverts. There is no excuse whatever for confusing the two fabrics, as they are of entirely different construction, the only point of similarity being the fine diagonal twill. Venetians are made from single yarns, both in warp and filling, while the true covert is made with a two-ply warp of contrasting colored twists and a single filling. The sample here illustrated was made from a stock mixture of two grades of wool well combined with a fine shoddy. To many manufacturers the stock mixture used will appear incapable of being spun to weavable yarns of the size here given, but with the proper equipment in the carding department and a capable overseer, no serious difficulty will be encountered.

Good Cards and a Skilled Carder Necessary.

It must be distinctly understood, however, that both elements of this proposition must be present in order to secure the desired results. For the manufacture of piece-dyed Venetians the Texas wools are very nicely adapted, giving a fabric that is well felted and with an exceptionally soft, full handle in the semifinished cloths. The wools to be used will differ with the type of finish required, which varies extremely at different seasons. At times the trade will have nothing but cloths that are well cleared out, with the twill prominent and every thread distinct, very much re-

sembling that closely related fabric, the whipcord, while another season demands a fabric with considerable nap and the twill scarcely discernable.

It is a matter of extreme difficulty to describe the different varieties of wool so as to enable those not thoroughly familiar with the various grades and types to differentiate between them. It is only by being brought into



12-Ounce Venetian.

actual contact with the stocks over a considerable period of time that one is able to determine with any degree of accuracy the particular type of wool

Best Adapted for the Fabric

to be manufactured. This feature of manufacturing has not received the attention that its importance demands. Many of those engaged in the textile industry both in the manufacturing end and the merchandising of the product, lay undue stress upon designing, as though style was the all-important feature. Granting that, other things being equal, style has more to do in creating a market for the product than anything else, it must also be admitted that a line poorly constructed, no matter how intelligent the styling may be, will never meet with success.

It is especially essential in these days of severe competition that the manager of a textile mill should be an expert manipulator of stocks, as it is in this part of the manufacturing that profits may be made or lost very rapidly. For the production of the mixture Venetians, which imitate the true coverts in shade, it is advisable to use a pulled wool for the white in the mix. There are several excellent reasons for so doing, one of the best being the fact that a pulled wool can be obtained that will be more open, freer, and less apt to cause specks, which is a very common defect in mixtures. Another defect frequently found in mixtures, particularly those containing a very small percentage of one color, is a blotchy or streaky appearance, due to improper mixing. The writer has seen many prices which were rejected by the sponger for this reason alone. The cloth was perfect in every other respect, but it would be impossible to make it into salable garments because of the unevenness of the mixture. That a defect of this sort should appear in woolens is not, perhaps, to be surprised at, as the process of carding in use to-day makes so few doublings possible, but the same imperfection is not infrequently seen in worsted goods where the doublings in manufacturing the yarns are so numerous. To obviate

danger of imperfections of this sort, the man in charge of the picking should be instructed to use great care in laying down the batch, and to give at least

Three Runs Through the Mixing

picker. The oiling should have careful attention that every part of the batch may receive its due share of lubricant. It may be that these details are enlarged upon unduly, but so many cases have been brought to our attention in which the sole cause of the difficulty was lack of attention to one of these so-called "minor details," that it is evidently necessary to emphasize them, that they may be borne in mind. The question as to the best oil to use as a lubricant during the carding and spinning is one that must be decided by the individual manufacturer. There are those who will under no circumstances use anything but a red or a lard oil, while in other mills mineral oils are used exclusively, and with very satisfactory results. As a general proposition, it is safe to say that the best oil is the cheapest. The emulsion may be formed with varied proportions of oil and water, as the judgment of the manager may indicate. For the stock used in the sample here described the proportions may be one-third oil and two-thirds water, cut with borax or some other mild alkali. This should be applied warm at the rate of twelve quarts per hundred pounds of stock, and the batch beaten with a pole to secure penetration.

The cards should be in A1 condition, set fairly close, so as to eliminate all danger of specks, the roving well rubbed, and made for spinning at half draft. Spinners should be instructed to make no splicings on the yarn intended for warp, but to tie all broken ends. Spooling, in itself an extremely simple operation, may be the cause of much trouble and many imperfections in subsequent processes, if carelessly performed. The operatives must tie the knots so that there is no danger of slipping during dressing or weaving, breaking the ends off short, so that they will not become entangled with the threads and cause them to break during weaving. Fabrics of this character are usually woven on the five or seven harness doeskin weave, either of which will form "floats" easily, that is, a slight lump of flyings, or the long ends of a knot are very liable to prevent the warp threads from

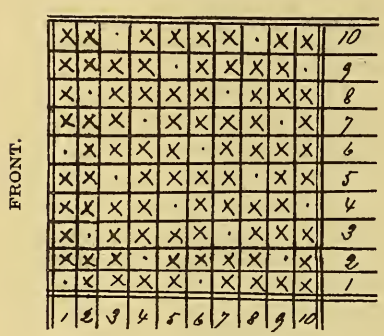
Interlacing with the Filling

properly. The weaver must use great care to guard against imperfections of this nature, or the cost of sewing will be increased to a marked degree. Burlers must remove every knot, leaving the ends to be clipped off by the shear. After sewing, the pieces may be taken to the wet finishing and prepared for the mills.

The use of a soaping machine is strongly advised, particularly on goods of this character which full very easily. Even application of the soap is absolutely essential in order to secure evenly fulled pieces. The soap should be made up from a pure neutral palm oil base, built up with a pure alkali, absolutely without any trace of free caustic. After running a few minutes the goods should be examined to see that the grease and dirt are being properly raised. This may be readily ascertained by holding the cloth over the fingers and scraping the thumb nail against the cloth. If the soap is of the correct consistency with sufficient detergent qualities the dirt and grease will flow out over the thumb nail readily. Full to fifty-seven inches, then wash thoroughly and dry. If the finish desired requires considerable nap, the pieces may be placed on the wire napper or gigs before drying, but for a clear finish they should be dried, then given a light napping

or more properly "raising," as the object in view is not to form a nap, but to raise the fibres so that they may be readily removed by the shear. After shearing, brush, dew and press.

Selvage on extra harness, or straps on basket; 2 and 2 to keep it from rolling.



STRAIGHT DRAW.

Five harness.
Doskin weave.

Layout:
3,468 ends. 50 picks an inch.
Reed: 10½—5—69.1 inches between the listing.

Warp:
3,648 thr., 6 run ..... 6.08 oz.

Filling:
50 picks, 5½ run ..... 6.40 oz.

12.48 oz.
Loom shrinkage, 10% ..... 1.25 oz.

Loom weight .....13.73 oz.

COST CALCULATION.

Material:

50% fine wool @ 56c.....	=	$ .2800
30% medium wool @ 44c.	=	.1320
20% fine shoddy @ 24c.....	=	.0480
	16)	$ .4600
An ounce		$ .0288
13.73 ounce stock plus 15% shrinkage = 15.50 ounces @ 2.88c.	=	$ .4464
Manufacturing:		
50 picks	=	.3330
Mill cost		.7794

LADIES DOUBLE-FACE GOODS

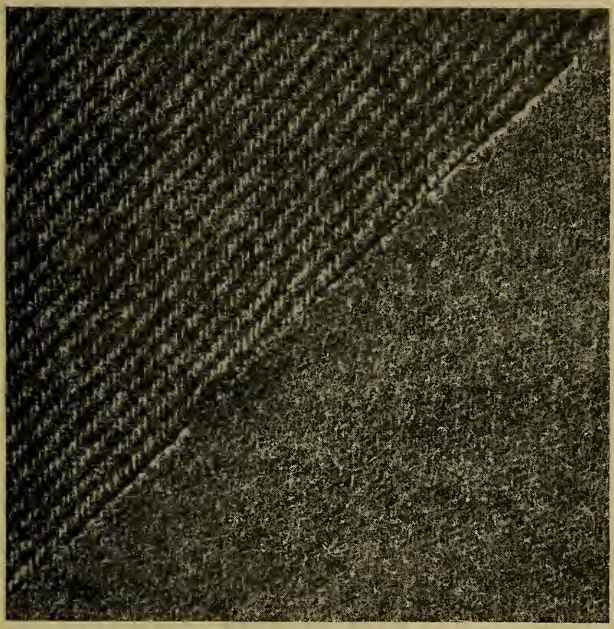
The manufacture of goods of this character requires the use of fine wools, and should not be attempted unless the preparatory machinery in the mill is in A1 condition. Fine yarns cannot be produced with any degree of success with card clothing in the condition of that in many of our mills. The wool selected for the sample here described is a fine selected Montana, which costs on to-day's market 56 cents per pound clean. The stock mixture is composed of 75 per cent wool and 25 per cent of a fine shoddy. The wools should be carefully sorted, then scoured with a mild detergent, the working qualities of the wool depending, to a very considerable degree, on its treatment during the scouring operation.

The custom in many mills, now being rapidly superseded by the mechanical wool washer, was to use the old-fashioned hand tub and rinse box. Too often this primitive equipment was entrusted to the care of low-priced help, with no idea of the irreparable injury that might be done to the staple by carelessness in handling. The scouring bath was made up of harsh soaps and soda ash, a combination that even in the

Hands of Skilled Operatives

must be used with great care. This mixture was boiled up in a circular vat, then water added until the liquor was bearable to the hand. A part of the wool to be scoured was then thrown into the tub and agitated with a pole for a short time and allowed to stand until the grease and dirt were

well softened. A part of the stock was then removed with a fork and placed on a rack to drain, a sloping table under the drainer returning the surplus liquor to the vat. The next operation was the rinsing, accomplished by throwing the wool into the "rinse box," where it was subjected to the action of a stream of water, usually taken from the fore bay of the water



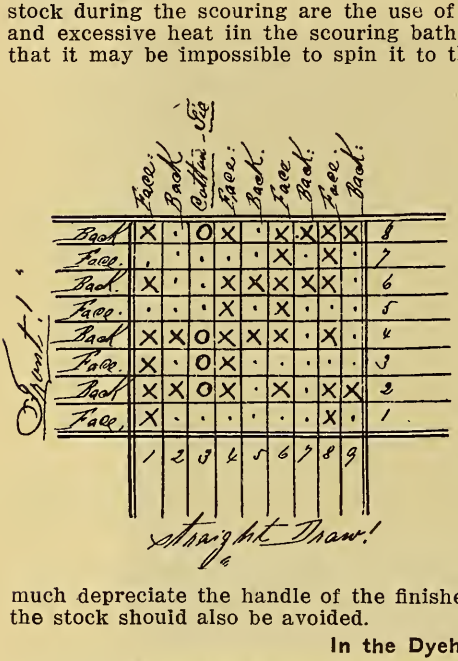
Double-Color Twill Face and Lone-Colored Back.

wheel, and frequently none too clean. That excellent results are obtainable by this method is not to be denied, but that in many instances the results were far from satisfactory is a fact well known to many who have had to deal with stock scoured by incompetent workmen. It must not be understood from the foregoing that the trouble was entirely with the method, as many of our present-day superintendents have seen goods produced from wools scoured in the hand tub that would compare very favorably with any produced in the latest of our new mills with their modern equipment. In the former days, as at present, it was largely a question of men, not methods. The great mistake was made frequently of underestimating the importance of an apparently simple operation.

Cleansing the Wool

from the natural impurities is apparently a process requiring no particular skill, nor should it be necessary to pay high wages to the one in charge of the scouring. A careful examination of the fibre and an intimate knowledge of its physical structure reveals to the student the necessity for care in handling such an intricately constructed fibre in every process of manufacture. Under the microscope the wool fibre is seen to be covered with

innumerable scales, or imbrications, which may be easily injured by harsh treatment. The spinning and felting properties are largely dependent upon these imbrications, as during the various processes of manufacture they interlock with each other, particularly in the fulling, and aid materially in making the cloth a firm, compact fabric. The chief sources of injury to the stock during the scouring are the use of too severe alkalis as detergents and excessive heat iin the scouring bath. Either will so affect the stock that it may be impossible to spin it to the desired size, and also will very



Warp:
1 thr., light mix face.
1 thr., fancy back.
1 thr., cotton binder.
1 thr., light mix face } 3 times.
1 thr., fancy back }

Filling: 9 thr.
1 pick, dark mix face.
1 pick, fancy back.

2

much depreciate the handle of the finished goods. Excessive heat in drying the stock should also be avoided.

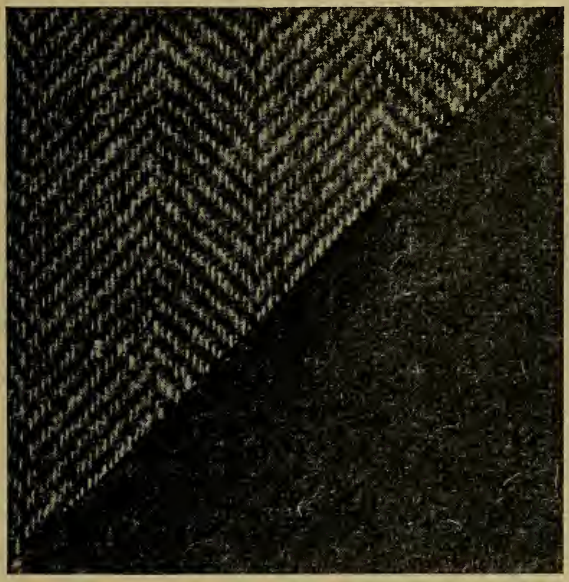
In the Dyehouse.

Wools for manufacturing the fabrics here described must be stock-dyed, that is to say, colored in the raw state, as it is neither practical nor profitable to color wool yarn in the skein. The method of dyeing to be used is a matter for the dyer to decide. The use of acid colors is common practice on dress fabrics, but does not give colors that will compare with alizarines for fastness, either to light or fulling. If alizarine colors are to be used they may be either bottom chromed or colored by the top chrome method. The latter method is preferred by many dyers, as they think the colors developed in this way are brighter and livelier than those colored by bottom chroming. Care must be taken not to allow the kettle to boil too hard, as it has a decided tendency to "rope" the stock and render it difficult to card and spin besides injuring its felting properties. After coloring, rinse well and dry. The wool and shoddy must be thoroughly mixed in the picker house, and should have an application of four quarts of oil to the hundred weight of stock. It is customary to apply the oil in the

Form of an Emulsion,

which may be mixed in the proportion of one pail of oil and two pails of water, emulsified with borax, sal soda, or some other mild alkali. The application of twelve quarts of emulsion will give the required amount of oil, and add sufficient moisture to insure the stock working nicely on the cards.

The carding of stock for fine yarns requires considerable skill, and also necessitates the keeping of the card clothing in good condition. The workers on the first breaker should be set with at least a 28 gauge, and many



Double-Colored Herringbone Face and Lone-Colored Back.

carders insist that a 30 gauge would improve matters. The finisher should be set with a 32 gauge, the rings nicely adjusted to the cylinder, and the corduroy wipe roll newly covered, if it shows signs of much wear. With the stock mixture used in the sample, it may be necessary to give the spinner slightly more than half draft, always keeping in mind the fact that

Layout:
3,600 ends, 52 picks.
Reed: 12—5, 4—66.66 inches between listing.
Don't count binder in reeding.

Warp:	
3,200 thr., 6 run	5.33 oz.
400 thr., 3/40 cotton, 10½ run	0.38 "
Filling:	
52 picks, 6 run	5.95 "
	11.66 oz.
Loom shrinkage, 10%	1.16 "
Weight out the loom	12.82 oz.

COST CALCULATION.

Material:		
75% fine wool @ 56c. a lb	=	$ .4200
25% fine shoddy @ 24c. a lb	=	.0600
	16)	$ .4800
An ounce		$ .0300
12.82 ounce stock plus 15% / 14.74 ounce @ 3c.	=	$ .4422
Manufacturing:		
52 picks	=	.3410
Mill cost a yard		.7832

in order to make a round, strong thread, it must be drawn on the mule sufficiently to straighten out the fibres to the greatest possible extent. The top and bottom spools on the cards should be kept separate and spun on separate mules, unless the machines are equipped with double roving gears, as are the latest types of nearly all makes. Even with the best of equip-

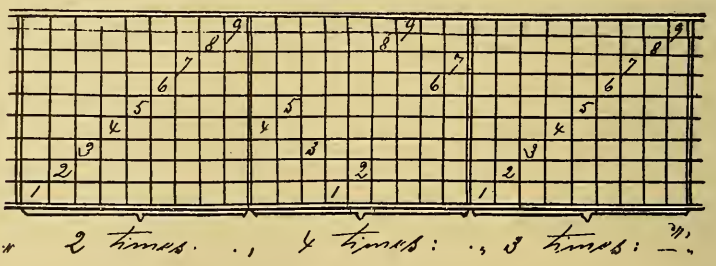
ment it is a matter of some little difficulty to get yarn from both doffers exactly alike, and it is advisable to keep the yarns separate in the weave room if they are to be used for filling. Every spinner should be warned

Full Draft.

to tie all broken ends, not alone for the reason that splicings made in front of the rolls are apt to pull apart in the loom, but to avoid the lumps in the yarn that usually accompany unskillful splicing.

The question of sizing the warps on the dressing frame is one that admits of good arguments on both sides, but it is very probable that the time lost in the dressing room, owing to the slow speed at which the dressers may be operated when running sized work, will be more than compensated for by the increased production in the weave room. Some dresser tenders object to using a warp compressor, but the experience of many years has amply proven that warps beamed with its aid will run much better in the

Drawing-in Draft.



loom, as the life and elasticity of the yarn is conserved to a remarkable degree. With well-made yarns, the weaving should proceed with a minimum of difficulty. The weaving of double-face goods is usually performed with that side up which has the

Most Difficult Pattern

to care for. If both sides are of a solid color, or simply contrasting warp and filling, it is immaterial which side is uppermost. The burling must

be carefully attended to, all knots and slugs removed before the pieces are sent to the sewers. The sewers should replace all broken threads and picks, both back and face, repair floats and all other damages as far as possible.

In the wet finishing, a very serious and not uncommon defect in goods of this kind may develop, that is the showing of the back color on the face, or vice versa. This is oftentimes attributed to faulty work in the dyehouse, the finisher claiming that the colors have bled and stained the goods, but in the majority of cases the trouble will be found in the fulling mills. The goods have been run too long, the result being that the

Fibres Have Worked Through

and are showing on the opposite side. The remedy for this is obvious. The goods should be so constructed that the fulling may take place without danger of such a result. Full to 57 inches and transfer immediately to the washer. Run for twenty to thirty minutes in warm water. The goods should lather up freely without the addition of soap. Rinse thoroughly and extract. If the goods are to have a velour finished back, take to the napper before drying, as the nap may be raised much more easily in the presence of moisture and with much less loss of stock. Dry, brush and shear both sides, brush, spray and press. These fabrics are made in a variety of styles and weights, with plain and fancy backs. The illustration at the head of this article shows a plain twill face and back. The second illustration shows the same fabric with a herringbone pattern. Special attention is called to the method of uniting the face and back fabrics by means of an independent cotton tie thread. This has been found to eliminate the defect formerly so often found in double-face goods, the so-called stitchy appearance due to binding the cloths by lowering the face warp to the back for one pick, or the opposite method of raising a thread of the back warp over a face pick. Both fabrics have the same layout, calculations and chain drafts.

WOOLEN SUITINGS

13½-Ounce Woolen Suiting.

The decadence of the carded woolen division of the textile industry is explained in a variety of ways to suit the ideas of the speaker. When the final

analysis is made, it will probably be found that an element of truth exists in several of the apparently very diverse reasons given. There are to be found those who are sincere in their conviction that the entire trouble is due to inequitable tariff legislation, claiming that the Payne-Aldrich Bill gave manufacturers of worsteds a great advantage over the carded woolen mills. Others are equally sure that the reason for the greatly reduced demand for woolens is the result of a change in the type of fabric desired by the ultimate consumer, while still another argument advanced is that woolen mills

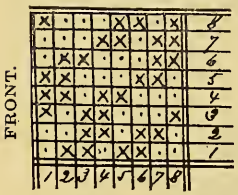
Have Not Been Progressive,

and have failed to keep abreast of the times, developing no new cloths that appeal to the wearers, forcing them to turn to the worsted mills for fabrics such as they desire. The materials here illustrated and described, while presenting nothing particularly novel in construction or design, are such as would prove very attractive to one in search of a suit that would combine service and appearance. With well-selected stock, well manipulated in the carding and spinning rooms, a yarn may be produced that will permit of

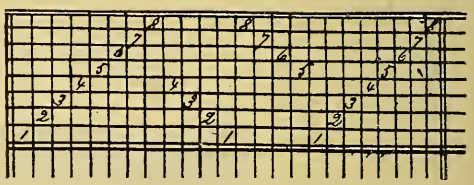
DRESS ED.

Black,	3½ r.	5 . . . . 6 . . . . 5 . . . . 6 . . .	= 23
Red,	3½ r.	. 1	= 1
White,	3½ r.	. . 2 . 2 . 2 . 2 . . 2 . 2 . 2 . 2	= 16
Lavender,	3½ r.	. . . 2 . . . 2 . . . 2 . . . 2 . .	= 8
Blue,	3½ r.	. . . . . 1	= 1

= 48 thr., one pattern. 480 one section. 5 sections = 2,400 ends.



CHAIN DRAFT.



DRAWING-IN DRAFT.

Woven 4 run black.
Layout:
2,400 ends, 40 picks.
Reed No. 9—4—66.77" between listing.

Warp:
2,400 thr., 3½ run ..... = 6.86 oz.

Filling:
40 picks, 4 run ..... = 6.86 oz.
Allow ½" for listing.

13.72 oz.
10% loom shrinkage ..... = 1.37 oz.

Loom weight ..... 15.09 oz.

COST CALCULATION.

Material:
Med. grade wool @ 40c. = 2½c. an oz.
15.09 oz. plus 15% shrinkage
17.35 oz. @ 2½c..... = $ .4337

Manufacturing:
40 picks ..... = .2910

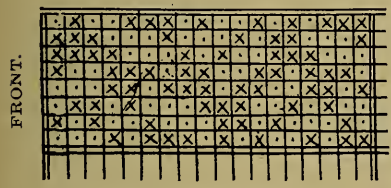
Mill cost ..... .7247

finishing the fabric in such a manner that it will very closely approximate a worsted in its appearance, and in actual service will give much better satisfaction to the wearer than a worsted fabric at the same, or even a slightly higher price. One of the very serious objections to a worsted made from

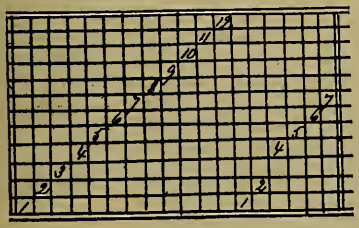
the lower grades is the fact that nothing will prevent its becoming shiny in spots with comparatively little wear. This is not so apt to be the case with a woolen, and

Another Advantage

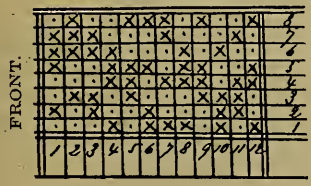
in the woolen suit is that it will retain its shape much longer than a cheap worsted. With the wool of the entire world at their disposal on equal terms with their competitors here and abroad, manufacturers of carded woolens should be in position to prove their contention that their lack of business was due to inability to secure raw materials on as favorable terms as their brethren in the worsted trade. The type samples were made from well-grown fleece wools of medium grade, carefully sorted, and scoured with intelligence. The latter item is one of the most important in the whole scheme of manufacturing. The majority of scourers are imbued with the idea that wool scouring has as its only aim and object the thorough cleansing of the fibre from the foreign matter it contains in its natural state.



FULL DRAFT.



DRAWING DRAFT.



CHAIN DRAFT.

13½-Ounce Woolen Suiting.

While this is the primary object to be obtained by the scouring process, the fact should not be lost sight of that in addition to cleansing the wool it is extremely important that the

Life, Elasticity and Luster

of the fibre is not impaired, and that the physical structure of the fibre itself is not injured in any way during the cleansing process. That irreparable injury may be done the wool by carelessness or inattention on the

part of the scourer is a fact so well known as to require no lengthy proof at this time. The use of harsh detergents, too great heat in the scouring bath or during the drying, will have a deleterious effect on the stock and render it totally unfit for the use for which it was intended, changing entirely the appearance and handle of the finished fabric.

Great injury may be done the fibre in the dyeing also, too severe boiling making the stock harsh in handle, brittle and tender, so that subsequent operations are attended with considerable difficulty and an excess of waste. Wool fibre is extremely responsive to kind treatment, and resents harsh handling to a remarkable degree. In the hands of skilled operatives it is susceptible of being made into the most delicate fabrics, with

A Finish that Rivals Silk

for softness and sheen. On the other hand, if handled without regard to its delicate structure, it will produce a fabric that is harsh to the touch, unsightly and unattractive in every way. See that the stock is well opened and mixed in the picker room, and sufficient oil of good quality applied to give it thorough lubrication in the carding and spinning, as otherwise it will be impossible to secure the desired results. The wool is of such quality that carding will be comparatively easy. The stock is lofty, standing up on the workers nicely and making very little waste. It will not be necessary to set closely, as the stock is open and very free. In condensing, the rub aprons should not be set too close, the stock forming an excellent roving without excessive rubbing. Make the roving half draft, setting the drawing-out scroll so that the carriage starts out at fairly good speed. If the carriage speed is low in starting from the rolls, the roving gets too much twist, with consequent difficulty in drawing. A very important item in the spinning of these yarns is the proper drafting on the mules. Good even yarn cannot be made without a fair amount of draft, though many spinners seem to lose sight of this fact. Twist the warp twenty turns to the right, the filling 16 turns right twist, making a strong, round, smooth thread. Dressing warps from yarn of this kind that has been well spooled is a pleasure, there being no occasion to stop except to change the reel when sections are full or to tie in new spools. Beam hard with warp compressor on the beam. Production from the weave room should show a

Very High Average,

as the weavers will have little to do aside from changing shuttles, the warps running with practically no breaking of threads from start to finish. When taken from the looms, the pieces should immediately be perched, measured and weighed, the details, including piece number, loom number, date and weaver's name, being entered on a suitable blank. Burl carefully, raising the knots on both sides and breaking them off with long ends, remove all slugs, filling drawn in or other imperfections of like nature. Sew in broken ends or picks, repair floats, holes or like damages, when the goods are ready for wet finishing. As it is proposed to give the goods a clear finish, the fulling should be done with a view to shrinking, not felting, and an hour's run in the mill should be ample to accomplish this. Scour thoroughly in warm water, rinse and extract. The handle and appearance of the goods would be much improved by a treatment on the wet brush, not for the brushing, but to facilitate steam blowing and a subsequent forcing of cold water through the roll. This should be done twice, changing ends on the roll between operations. Extract in the open if possible, and dry at a moderate heat. Give a little light work on old teasels to facilitate shearing, which must be as close as possible. Brush, spray and give a hard pressing.

DRESSED.

Black,	3½	3	.	.	.	.	4	.	.	.	= 16
Red,	3½	.	1	.	.	.	.	.	.	.	= 1
White,	3½	.	.	2	.	2	.	2	.	2	= 16
Lavender,	3½	.	.	.	1	.	.	.	1	.	= 4

3 times.

= 36 thr., one pattern.
396 ends to one section.
6 sections = 2,376 ends.

Woven plain black, 4 run.
Layout:
2,376 ends, 42 picks.
Reed: 9—4—66" between listing.

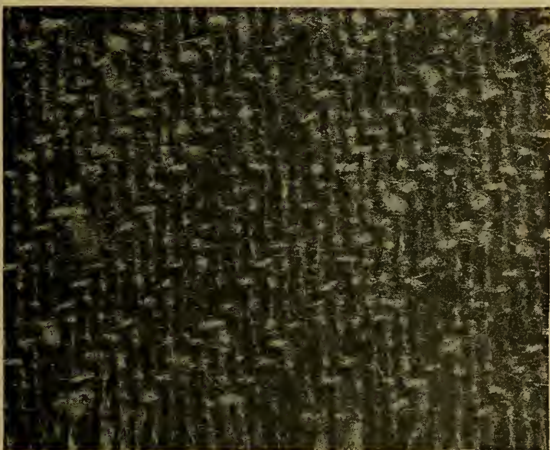
Warp:		
2,376 thr., 3½ run...........	=	6.78 oz.
Filling:		
42 picks, 4 run..............	=	7.12 oz.
		13.90 oz.
10% loom shrinkage......		1.39 oz.
Loom weight		15.29 oz.

COST CALCULATION.

Material:		
Med. grade wool @ 40c. = 2½c. an oz.		
15.29 and 15% shrinkage.		
17.58 at 2½c..................	=	$ .4395
Manufacturing:		
42 picks	=	.3000
Mill cost		$ .7395

CAP GOODS

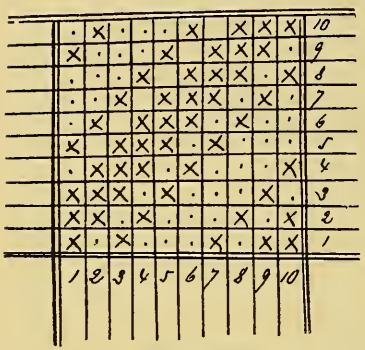
The manufacture of cloths especially for the cap trade is a comparatively recent innovation, but in the recent past has developed into a very important branch of the woolen industry. The fabric here illustrated is typical of many of the cloths now popular with cap makers. The yarns are made from medium wool and shoddy, spun to comparatively heavy counts with medium twist, so as to give a soft fabric with a bulky, woolly appear



9½-Ounce Cap Cloth.

ance and but little weight. The goods are of low texture and full readily no felt being required. Scour, dry and give a light shearing to take off the long hairs, brush and give a light pressing.

The medium-weight cap cloths similar to that here illustrated are frequently made with a stock mixture slightly different from that used in the type sample. Many of the rough, shaggy caps now so popular for sporting



Full Draft.

Straight draw, twill to the right.
Dressed and woven.
1 light
1 dark.

Layout:
1,088 ends, 18 picks.
Reed:
8—2—68 inches between listing.
Warp:
1,088 ends, 2½ run..... 4.30 oz.
Filling:
18 picks, 2½ run..... 5.00 oz.

2 in. allowed for listing. 9.30 oz.
10% for loom shrinkage..... 0.93 "

Loom weight.....10.23 oz.

COST CALCULATION.

Material:
70% medium grade of wool @ 40c. = $ .2800
25% medium grade of shoddy @ 20c. = .0500
5% white nub @ 50c. = .0250

16) $ .3550

10.23 + 15%. Per oz., $ .0222
Material:
15.35 oz. @ $ .0222..... = $ .3407
Manufacturing:
18 picks ..... = .2030

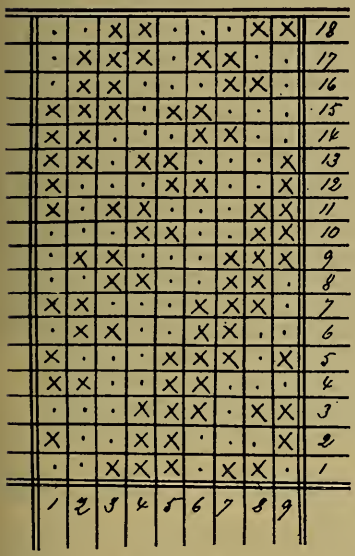
Mill cost, per yard..... .5437

wear are made from a mixture of Joria wool, garnetted quarter-blood thread waste, and for the white in the mixture, a bleached China wool. A mixture of this kind made from tastefully selected colors produces a fabric

Medium-Weight Cap Goods, 14½ Ounce.

that has the nobby look that many people think is only to be found in foreign fabrics. A glance over the line of some of our first-class domestic makers will soon disabuse one's mind of any such idea. Have the stock well

carded, and spin with medium twist at two-thirds draft. This will produce an excellent weaving thread. Goods of this character should be fulled as quickly as possible and immediately transferred to the washer. Scour thoroughly, dry and shear only enough to take off the long hairs. Brush, give a light pressing and roll up.



Straight Draw.

Climbing diagonal to the right.
Dressed and woven.
1 thread dark.
1 thread medium.
1 thread light.
3 threads, one pattern.

Layout:
1,260 ends, 24 picks.
Reed:
9—2—70 inches between listing.
Warp:
1,260 thr., 2 run..... 6.30 oz.
Filling:
24 picks, 2 run..... 8.09 oz.

Allow two inches for listing 14.39 oz.
10% loom shrinkage..... 1.43

Loom weight.....16.39 oz.

COST CALCULATION.

Material:
75% medium grade of wool @ 40c. = $ .3000
25% med. grade of shoddy @ 20c. = .0500

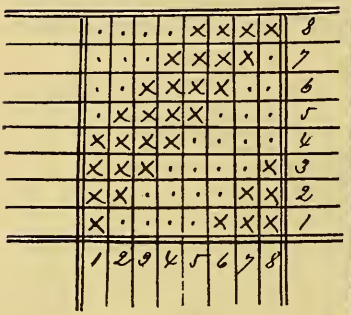
16 oz $ 3500

Per oz. $ .0219
16.39 oz stock and 15% shrinkage
18.04 oz. @ $.0219.....= $ .4125
Manufacturing:
24 picks .....= .2260

Mill cost, per yard..... $ .6385

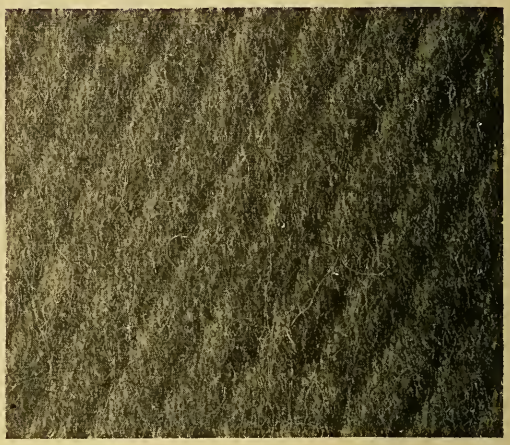
The 20-ounce fabric shown here has not only been very popular for caps but has sold very largely to the cloak houses, particularly when made with warp of one color and filling of another, in all sorts of contrasts, from the ever popular black and white through the various shades of blues, browns and tans. The only difficulty in the manufacture of fabrics such as this, with contrasting colors in warp and filling, is to obtain even yarns and have weavers so well trained that there will be no light and heavy places across the piece, as these will show in the finished goods, oftentimes requiring an allowance. How to overcome this is a question much discussed among loom fixers and boss weavers. Some insist that such goods should never be woven except on looms with positive take-up, while others are just as thoroughly convinced that better results can be obtained by the average weaver, with the conditional take-up. When putting the warp in the loom, the fixer should see that the beam heads are perfectly smooth, and put on new friction bands covered with graphite powder. See that the arbors of the beam are true, and that the take-up is working freely. Try to so adjust the take-up and friction that the picks will beat up a trifle, as the cloth will be much more even than would be the case if the picks went into

the fell of the cloth with no beat. Full to 57 inches, wash, dry and shear lightly, brush and press.



Full Draft.

Straight draw, twill to the right.
Dressed: Plain color.
Woven: Fancy mixes.



Heavy-Weight Cap Goods, 20 Ounce.

Layout:
1,360 ends, 14 picks.
Reed:
10—2—68 inches between listing.
Warp:
1,360 thr., 2 run..... 6.80 oz.
Filling:
14 picks, ¾ run.....13.00 oz.

2 inches allowed for listing. 19.80 oz.
10% loom shrinkage..... 1.98 oz.

Equal loom weight.....21.78 oz.

COST CALCULATION.

Material:
50% medium grade wool @ 40c..... = $ .20 0
50% medium grade shoddy @ 20c... = .1000

16)$ .3000
Per oz. $ .0188

21.78 plus 15%.
3.26 ounce.

25.04 ounce @ $.0188.....= $ .4707
14 picks .....= .1880

Mill cost, per yard..... $ .6587

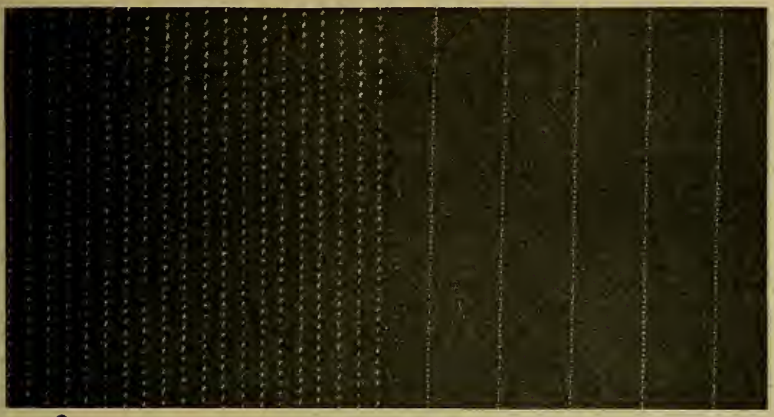
MEN'S WEAR PENCIL STRIPES

The illustration herewith shows two typical styles of pencil stripes for men's wear, which are extremely good representatives of this class of men's wear cloths in cross dyes. By a careful selection of the drugs used it is possible to color the worsted of the ground any desired shade without in any way changing the color of the silk threads used for the striping. There are several advantages in this method of manufacturing styles of this character, not the least of which is the fact that in so doing there is eliminated the necessity of dyeing the yarn in the skein, with the subsequent waste in winding and spooling. Not only is the colored waste of less value as a by-product, but yarns in the grey are stronger, making better weaving, and the operative has less strain on the eyes and is enabled the more easily to detect and remedy imperfections of various kinds as they may occur during the processes of manufacture. In order to produce a fabric that shall be satisfactory in appearance and handle, it is necessary that the superintendent or purchasing agent have a

Good Knowledge of Yarns,

so that he may select those best adapted for the fabric to be manufactured. The finish required and the handle desired in different seasons vary very

materially, and the type of yarn used from time to time will be very prominent factors in securing the result that is the aim of every official of the concern, that is, a cloth that is good value can be produced in quantity, and will show a fair profit. The unwise selection of yarns is in many cases the cause of dissatisfaction throughout the mill, the winding is slow and difficult, the waste excessive, and production far below what it should be, the usual result being that the weavers are unable to earn wages commensurate with the labor involved, and an exceedingly high cost in the



Two Typical Styles in Pencil Stripes for Men's Wear.

finishing department, owing to the extra sewing required. It is simply an example of saving pennies and wasting dollars. An additional cent or two per pound in the price of the yarns would save several times that amount in the manufacturing cost per yard on the goods.

In the examples shown here the worsted for the warp is 2-40s half-blood,

Spun on the Bradford System,

from tops made from a choice territory wool. The filling is the same size, but is dry spun, that is to say, is made on the French system. For many years manufacturers were strongly opposed to the use of French spun yarns in cloth for men's wear, but of late this prejudice has been overcome to a considerable extent, and to-day many mills are using dry spun yarns in all their men's wear fabrics. There are several advantages to be derived from the use of such yarns, one of the greatest being a slightly better handle in the goods made from French spun yarns of the same grade, or even from the identical top. To secure the best results in the finished goods it is necessary to begin at the grease wool, using care and judgment in every process of yarn manufacture as well as in handling the yarn during its conversion into cloth. The fleeces are opened by the sorter, given a shake to remove loose dirt and impurities, and then spread on the sorting bench where the different grades are separated and thrown into baskets. It is essential that this part of the work be done by skilled workmen, as each fleece may be separated into several grades, the various parts of the sheep having an entirely different character of wool. The finest part of the fleece grows on the shoulders and sides of the animal. Next in grade is that from

the lower part of the back; third, that from the loins and back; fourth, that from the upper part of the legs and neck. Still lower in quality is the wool from the lower neck and middle of the back, with the breast, belly and skirtings the lowest sort in the fleece. In the hands of a skillful sorter, the fleece is capable of being more finely subdivided than outlined here, ten or eleven grades frequently being made from a single fleece. In scouring fine wools the use of a pure potash soap is strongly advised. The use of soda soaps or soda compounds of any kind should be prohibited in the cleansing of fine wools particularly, as the action of soda is injurious to the fibre, making it harsh to the touch, as well as detracting from its spinning qualities. The use of a pure potash soap, free from uncombined caustic alkali, will be productive of the best results. Tests should be made of all new lots of soap and alkali to see that they are free from impurities that may be injurious to the stock or that add to the cost without any increase of detergent properties. The scouring liquor should not be hot, a temperature of 120 to 125 degrees Fahrenheit is all that is needed to thoroughly cleanse the fibre, and irremediable damage may be done by excessive heat.

Another Essential Feature in Wool Scouring

is a supply of soft water. If this is not obtainable, it will be necessary to correct the hardness of the available supply by mechanical or chemical assistance. The wool need not be rinsed nor should it be thoroughly dry if the carding process is to immediately follow the scouring. The action of the cards on the moist fibre is much more gentle than on stock that is bone dry. The fibres in a moist condition are more pliable, less liable to break, and are combed out much more readily with a considerable lessening of noil in the combing. A very common source of imperfect yarn is a worn covering on the top roll of the roving or reducing frames. Slugs are formed here which entail a vast amount of labor in the finishing room. All the top rolls should be inspected at least twice daily, all defective rolls removed and replaced by those in perfect condition. A very little time and expense here will save hours of expensive labor in later operations. The

Inspection of the Yarns

in the spinning mill should not be hurried. A method which has many points in its favor is that used by one of our best mills. All yarns, even those to be delivered in the form of skeins, are first run onto jack spools at a slow rate of speed, enabling the operative to detect imperfections very readily as the yarns pass over the inspection board. By using a low rate of speed and a comparatively low number of ends, the inspection is practically perfect and the relatively higher cost of this close inspection is amply justified by the superior working of the yarn in subsequent operations as well as the greatly reduced expense of mending. The custom in nearly all mills making fabrics of this type is to dress on a dry frame and weave without sizing. The better way is to run through a slasher after dressing, as a sized warp will run better in the loom than one not so treated. It should not be necessary to dress the

Silk on a Separate Beam

if due care is used in the dressing department. The silk threads should be allowed to run with very little friction, as they are very much less elastic than the worsted and will cause considerable trouble in the weaving by excessive breakage if dressed too tight. In burling every knot must be raised on both sides of the cloth, all foreign matter, such as bits of dirt or chaff, removed in such a manner as to disturb the texture as little as possible. The sewers will replace all broken ends and picks, coarse threads or hard twist and remove the slugs. Scouring is an important part of the finishing of any type of fabric and is especially important in the

case of goods which are subsequently to be dyed. In the majority of cases of shady goods, the cause will be found, not in the dyehouse as is quite generally supposed to be the case, but in the finishing room, and in most cases the washing is the process at fault. It is impossible for the dyer to get level shades on goods containing dirt or soap. Worsted goods should not require severe treatment in the scouring, as they are comparatively free from the dirt and grease usually found in

Carded Woolens.

A pure, neutral, palm oil soap should be used, built up with a pure alkali to a strength sufficient to saponify the oils contained in the goods. The goods should be run in the soap bath from 20 to 30 minutes, then washed off in warm water for 15 minutes followed by a rinsing for half an hour in clear cold water. After extracting, the goods should be rolled on a machine which will remove all wrinkles and stretch them slightly in width, allowing them to remain on the rolls over night. A process, more to be recommended than this, however, is the continuous crabbing, for which several makes of machines are on the market. Next morning the pieces may be unrolled and are ready for the dyehouse. The goods are usually colored in a kettle holding from six to ten pieces, but must not be overcrowded. Do not bring to a boil too rapidly, but allow ample time to secure complete penetration. After dyeing, rinse well in cold water, extract and dry. The hastening of the drying operation by means of excessive heat must be avoided, as it has a decided tendency to tinge the silk stripe a yellowish shade. Give a run on the polisher, brush, shear and press. After pressing, a run on the dewing machine will improve the handle very materially. After a final inspection the goods are ready for rolling up, and if the pieces have received the care and attention they should have in the various processes, the silk will be found clear white, with the beauty and luster improved rather than diminished.

LAYOUT.

4,828 ends; reed 18—4 = 67" + 1½" for listing = 68½" over all.
72 picks.
Dressing pattern:

2/48 white	16	16	32
60/2 silk	2		2
			34

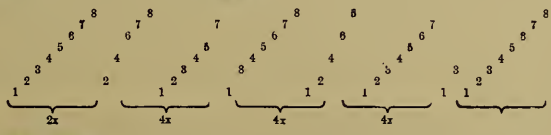
CALCULATIONS.

284 ends 60/2 silk = .05 oz. + 10%	= .099 oz.
4,544 ends 2/48 = 5.4 oz. + 10%	= 5.940 oz.
72 picks 2/48 = $\frac{72 \times 68.5}{48 \times 560 \div 2 \div 16}$	= 5.870 oz.
Loom weight	11.909 oz.

COST.

.099 oz. silk + 3% waste = 1.01 oz. @ $3.40 per lb.	= $ .0240
11.81 oz. worsted + 5% waste = 12.43 oz. @ 96c. per lb.	= .7458
Cost of stock	$ .7698
Cost of manufacturing, 72 picks.	= .3750
Net mill cost	$1.1448

Selling price $1.42½; terms, 10-30.



NEEDLE CORDS

The manufacture of staple dress fabrics such as this is confined almost entirely to a few of our large corporations who specialize to a certain extent on goods of similar construction. Only a few years since, buyers for our large department stores considered it necessary to buy the larger part of their high-texture dress goods in the foreign market, but of late domestic mills have given more attention to the production of such cloths, with the result that a large proportion of the business has been taken by American mills. The difficulty of weaving fine single yarns was probably the strongest argument against attempting to produce such fabrics here, but improved methods and machinery, combined with increased skill of the operative, has enabled domestic manufacturers to produce results that in all respects are equal to those attained abroad. The needle cord derives its name from the peculiar effect produced by the weave used in interlacing the warp and weft, the fine ribs, in some cases as many as 24 to the inch, showing the appearance that might be expected to result from innumerable punctures with a needle. One of the great objections to turning the equipment of a mill to this class of fabrics is the fine spinning required, with the consequent smaller production per spindle, and the very much less yardage produced per loom, owing to the high number of picks per inch in part, and partially also to the slower speed at which it is necessary to operate the looms when weaving fine single warps.

The yarns used must be well spun, free as possible from slugs and other manufacturing imperfections. In order to avoid the breakage in weaving which would be caused by the interlacing of the fibres clinging to the yarn made on frames, the yarns used in fine fabrics of this character are invariably mule spun. This method of yarn manufacture produces a much smoother thread than can be made on frames by either cap or flier spinning. In addition to this, another process is added to the yarn making, that is, the

Warp Yarns Are "Gassed"

or singed. This operation consists of passing the thread between gas flames, so adjusted as to burn off the extending fibres without injury to the thread itself. The result is an extremely smooth thread which presents much less opportunity for chafing than one not so treated.

The warps are run through the slasher, which gives them a coat of size, evenly distributed and thoroughly dried before the yarn is wound on the beam. Care must be taken to see that the drying is completed in the machine or the entire warp will be spoiled. Should the yarn be moist as it winds on the beam, successive layers will become so matted together that it will be impossible to weave them off except with a maximum of labor and expense and with a great opportunity for the making of imperfect goods. The best sizing materials to use is a much-discussed question. Some mills will have nothing but the best fish glue used, while others find many of the prepared sizes on the market very satisfactory. To obtain the best results a size must be used which possesses the qualities of good penetration, strong adhesive powers and drying hard, still retaining a certain degree of elasticity, and one that will stand considerable chafing without pulverizing. Without such a size, the weaving of fine single warps becomes impractical, as no weaver could be found to operate the looms under conditions such as would then exist.

The finishing of needle cords does not differ materially from the process used on a variety of clear-finished dress goods. The burling should be done carefully, all knots removed and slugs reduced. Scouring should be accomplished by the use of a pure neutral soap built up to suitable strength with

a mild alkali. After scouring, the pieces should go at once to the crabbing machine. For this work a

Continuous Crab Is Preferable

to either the single or double crab of the Yorkshire type. There are several reasons for this preference, as the operation is continuous and the machine does the work with less labor and expense. From the crab the goods should be rolled tightly on wooden rolls, covered with cotton cloth and allowed to stand for at least twenty-four hours, the rolls being turned end for end at intervals of not exceeding eight hours.

The dyeing is done in the usual manner, the kettle holding from ten to sixteen pieces, according to the length of pieces and size of tub. It is unwise to crowd the kettle, as good results cannot be expected if the machine is overloaded. When the correct shade is obtained, the dye liquor is drawn off, the goods cooled and rinsed in the kettle, then extracted and dried. After drying, the pieces are given a few runs on the brush, then sheared or singed, brushed, inspected and pressed. For goods of this character, or in fact any other class of goods, the old-style plate press will give superior results.

LAYOUT.

4,992 ends; reed 13—6 = 64" + 1½" for listing = 65½" over all.
160 picks.

CALCULATIONS.

4,992 ends 1/36 = 3.96 oz. + 7% take-up .....= 4.26 oz.

160 picks 1/48 = $\frac{65½ \times 160}{(48 \times 560) \div 16}$ ..= 6.24 oz.

Loom weight ..... 10.50 oz.

COST.

4.26 oz. + 5% waste =4.47 oz. @ 8Sc. per lb. .....= $ .2459

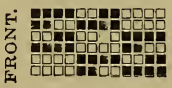
6.24 oz. + 3% waste = 6.42 oz. @ 96c. per lb. .....= .3852

Stock cost ..... $ .6311

Manufacturing. 160 picks .....= .6300

Net cost $1.2611

FRONT.



COTTON MIXTURE THIBETS

The thibet is a fabric much used for overcoatings in the heavier weights, and may be made from pure wool, as are the higher grade cloths, or with a mixture of cotton, shoddy and wool, as is the usual custom in manufacturing the lower-priced cloths. The appearance of the goods is somewhat similar to a melton, but has not the characteristic melton touch. The stock mixture must be governed to a great extent by the price at which it is intended to sell the finished goods, but it is essential that the materials used shall have sufficient felting properties to give a good cover to the face without excessive gigging or tender goods will result, one of the worst mishaps that can befall a mill. Imperfections of other kinds may be overcome to a certain extent or the goods sold as seconds at no great loss, but materials that are tender are practically impossible to dispose of at any price, except at their value as rags.

The greater part of the thibets are either solid shades or mixtures, but occasionally they are used as the groundwork for a pencil stripe or other fancy pattern. The fabric is what might be termed a "finisher's cloth," that is to say, it has little indication as it comes from the loom of what it will become under treatment by a skilled finisher with an equipment of machinery such as is found in a modern woolen mill finishing room. As the goods come from the loom they are of coarse, open texture, and to the ordinary

observer it would seem well-nigh impossible for them to be so manipulated as to become the soft, smooth-faced fabric fit to clothe the most fastidious. For the production of the sample here described the stock mixture for the warp was made up of the following:

20%	cotton @ 16c.	= 3.2c.
10%	wool @ 40c.	= 4.0c.
40%	card waste @ 10c.	= 4.0c.
30%	coarse extract @ 12c.	= 3.6c.
	Total cost per pound.	14.8c.

The filling mixture should have a larger percentage of wool in order to secure the necessary felting properties but in the manufacture of a low-priced fabric such as this, it is essential that the stock be secured at as low a price as is compatible with the results to be obtained. For the filling we will use a mixture made up of the following:

15%	wool @ 40c.	= 6.0c.
15%	cotton @ 16c.	= 2.4c.
30%	card waste @ 10c.	= 3.0c.
40%	coarse extract @ 12c.	= 4.8c.
	Total cost per pound.	16.2c.

The stock costs here given may look extremely low and lead one to think that the work will run badly through the mill, but such is not the case. With competent men in charge of the carding and spinning departments, there will be no trouble in making a thread that will be strong enough to weave without any difficulty and secure an excellent production.

In preparing lots of this character for the card room it will be found necessary to use more care than would be the case were the stock all wool of one or two grades. In order that the goods may full evenly and give no trouble in the dyeing, it is very essential that the various stocks should be blended into a homogeneous mixture. The lot should be laid out in the picker room in layers, containing as nearly as may be, without too much labor, the correct percentages of the various stocks. The oil should be put on the wool stock, as the cotton will absorb all that it requires from contact with the moist layers of woolen material. While it is a common practice to use a mineral oil as a lubricant for low-grade woolens, it is not to be commended. Mineral oils are not readily saponified, and there is possibility of having considerable trouble in removing the oil during the finishing process. A much safer method of procedure is to

Use Either a Lard or Red Oil,

either of which will saponify without difficulty, and may be removed with detergents of a much less harsh character than would be required in the use of a mineral oil. The emulsion may be prepared by placing in a barrel two pails of water to each pail of oil and cutting the oil with borax or some mild alkali. The emulsion should be applied warm, about twelve quarts to the hundred pounds of stock, which will give an application of four quarts of oil. The stock should be run through the picker three times to obtain thorough mixing, or the lack of even distribution of the various stocks through the mixture may become the source of trouble in subsequent operations. The cards should be in first-class condition, although many manufacturers seem to think that low stock may be put through any sort of a machine and good results be obtained.

It is a great mistake to attempt to make yarn from any kind of stock without first making certain that the equipment is in the best possible condition. The

Carding of Short Stock

requires no little skill and experience, as there is a strong tendency for the shoddy and card waste to leave the mixture, dropping under the cards, while the longer cotton and wool fibres are carried on by the clothing and con-

verted into roving. It may be necessary to change the setting of the cards, and to slow up the fancies if not the main cylinder to obviate too great a loss of the short stock. It is a decided advantage to have the cards doubled up for work of this kind, that is, to place the first and second breakers as near together as possible, interpolate a couple of extra rolls as conveyers which will take the stock from the first breaker doffer and carry it to the cylinder of the second breaker without the intervention of the Apperly feed. The roving should be made at least two-thirds the size of the yarn to be spun, as the stock will stand but a limited amount of draft. The warp yarn should be spun with the least amount of twist that will give the requisite strength, and should be right-hand twist. The filling may have considerably less twist, and must be spun to the left in order to obtain all the cover possible. Dress with no more tension on the spools than is necessary to give a fairly firm warp on the reel, as it is essential to retain all the

Elasticity and Life

possible in the yarns. It will prove advantageous to draw the warps on eight harnesses, thereby avoiding unnecessary crowding of the heddles and undue chafing of the threads during the process of weaving.

It is a great mistake, and one frequently made, to think that all that is required of a loom fixer is to put the warp in the loom, fasten the harness straps, tie in the warp, adjust the reed and start the loom. This is all simply preliminary work. After the heading has been woven and the broken ends tied in, the loom should be gone over with care to see that it is in the best possible shape to weave the particular fabric it is desired to produce. Adjustments of various parts may be made, which, while seeming of little importance, may affect the production very materially. The point at which the shed closes, relative to the position of the reed, the timing of the harness motion cylinders, and the picking motion, are all minor details, but in total of extreme importance. The shuttles should have a thorough examination, and all rough places gone over with sand paper, the points put in perfect condition and the "brushes" adjusted so as to give the proper amount of friction on the fillings to prevent "runners" or filling drawing in at the sides. The picking motion should be set in such a manner that both sides of the loom pick together, or with possibly a slight lead on the head motion side. The height of the harnesses should be sufficient to allow the bottom shed to clear the race plate nicely, yet not high enough to throw out the shuttle or cause split bobbins. Should the reed be shorter than the reed space at either or both ends, fill in the space, if of any size with small pieces of reed, nicely adjusted, avoiding a too common trouble, that of having the shuttles fly out, which not only lowers production but is a source of danger to the operative.

With well-made yarns the burling and mending will be a small item in the cost of finishing, but it must not be understood that the burling can be slighted. All knots should be raised on both sides of the goods, not pulled out or broken off too short, as such procedure will allow the ends to be drawn back in the fulling, leaving a "pin hole," which may not be detected except by looking through the goods. In order to

Obtain a Well-Covered Face

on fabric constructed of low stock, such as we propose to use, it will require a run on the napping machine before fulling. It will appear to some of our finisher friends that this method is somewhat out of the ordinary, but the results obtained fully justify this procedure. This breaking up of the face in the grease before fulling will give a much better fabric than one finsihed in the ordinary manner.

By this preliminary napping the fibres are put into much better condition for felting during the fulling operation. In running the pieces into the mill start them with the nap pointing toward the rolls, as a much more

closely matted surface will be obtained in this way. The soap will need to be full bodied, long lived, and well fortified with alkali to fully saponify the grease and oil contained in the low stock mixture. A combination of fifty per cent pure tallow and fifty per cent palm oil will be found to do the work nicely. We do not advocate the use of tallow soaps on goods which may be fulled in a short time, but for fabrics which require long, hard fulling they are practically a necessity, as palm oil soaps will not retain their vitality under these conditions. It is impossible to give a

Hard-and-Fast Formula

which will give perfect results on all kinds of goods, each finisher usually having certain proportions of soap and alkali which he has found to be well adapted for the stocks and fabrics manufactured by the mill in which he is employed.

If the soap used is of the proper strength to hold the grease and dirt in suspension through the process of fulling, it is very probable that no additional quantity will be required in the washer. The pieces should be taken directly from the mills to the washing machine and scoured with sufficient warm water to float them and rinse out the impurities. After twenty to thirty minutes in the suds the dirty liquor should be drawn off and the goods given a thorough rinsing, first with warm then with cold water, until every trace of soap has been removed. Extract for five minutes and place on the napper before sending them to the dyehouse. Thibets should not be napped all one way, but the pieces should be reversed at about the middle of the operation. On the fabric here described three runs in each direction should be enough to give the desired amount of nap.

The dyeing is accomplished by means of any good union dye, and plenty of time must be given to secure thorough penetration of the fibre. Do not overload the kettle or bring to a boil too rapidly or uneven goods may be the result. The goods must be cooled off and well rinsed before being removed from the dye kettle, then thoroughly extracted and dried. In drying, the

Heat Must Not Be Excessive

or the handle of the cloth will be seriously impaired. When dry, give the pieces a couple of runs on the brush, then shear to match the finish desired. If the goods have been properly handled they will have a short thick nap with no threads visible. Give the pieces a final inspec-

LAYOUT.

2,800 ends; reed 10—4 = 70" + 1½" for listing = 71.5" over all.
40 picks.

CALCULATIONS.

2,800 ends 2¾ run = 10.18 oz. + 5% ..... = 10.70 oz.

40 picks 3 run = $\frac{71.5 \times 40}{300}$ ..... = 9.53 oz.

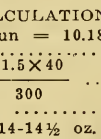
Loom weight ..... 20.23 oz.

Finished weight 14-14½ oz.

8 harness, straight draw.

FRONT.

Listing



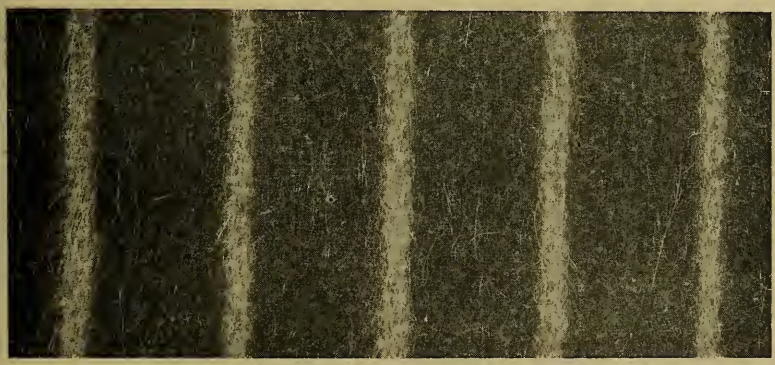
COST.

10.7 oz. warp + 25% shrinkage = 14.27 oz. @ 14.8c. per lb. =	$ .1273
9.53 oz. filling + 25% shrinkage = 12.7 oz. @ 16.2c. per lb. =	.1287
	$ .2560
Labor =	.2000
Incidentals =	.1200
Net mill cost	$ .5760
Profit =	.0640
Discount, commission and guarantee =	.1600
Selling price	$ .8000

tion before brushing, and a run of steam before they are placed on the dewing machine. It will be found that a fairly heavy spray may be used to advantage before pressing, thereby improving both the handle and appearance of the goods. Run on the press with face to the cylinder under fairly heavy pressure, give a light run of steam and the goods are ready for rolling up.

ZIBELINE COATINGS

The name zibeline is applied to many fabrics which are somewhat allied in appearance to the real zibeline, yet are made from entirely different stock and are easily detected as imitations. The present fall season's offerings of ladies' coatings are made up largely of fabrics under this name, while but few of them are rightfully entitled to it. The true zibeline is a fabric with a straight, glossy nap which entirely obscures the weave, and a rich luster which closely approximates that of a glossy fur. The imitations are largely made of a coarse wool and, though finished in a similar manner, are entirely lacking in the rich glossy appearance which denotes the real article. The construction of these fabrics is very similar to that of the ordinary cheviot, the important difference being in the stock employed. In the cheviot a coarse wool is used which is more or less curly in its nature, while in the manufacture of the zibeline a percentage of mohair is blended with the wool. Mohair is the fleece of the Angora goat, and is a long comparatively straight fibre, having a silky luster, which gives the finished goods a bright glossy appearance which it is impossible to attain with wool. There are several variations of the fabric which are popular this season, some in single cloths, others with fancy backs in stripes or plaids, some with the face of a solid color,



Zibeline Coating

others with a distinct color pattern on both face and back of the goods. The style here first described is a single cloth of a solid color, probably woven in the white on the double loom system, with a warp of fine yarns in the second loom. The yarns are coarse and

Require No Special Skill

in their manufacture, though trouble may come in the spinning, if an attempt

is made to spin with too much draft, owing to the slippery nature of the mohair fibre, due to the comparative lack of the imbrications or serrations peculiar to wool. The pieces are fulled and scoured as usual, then put on the wet gig to raise and straighten the nap. This operation is carried on while the goods are wet, as the tangled fibres are much more readily straightened out while rendered soft and pliable by the water.

The wire napper is not as well adapted to this class of fabrics as the old-fashioned teasel gig which is not so harsh in its action. The gigging is all in one direction, as the desired result is a long straight nap. When the pieces are napped sufficiently they are placed on a wet brush to thoroughly straighten out and lay the fibres close to the cloth. The roll on which the cloth is wound on this machine is a tube with many perforations, connected with pipes and valves which permit of forcing steam or water through the goods while rolled. The blowing of hot steam through the pieces followed by cold water sets the cloth and imparts an added luster. If piece dyes, the goods are now ready for the dye-house and are usually colored in kettles holding from six to eight pieces. In coloring napped goods it is absolutely essential that the pieces run in the direction opposite to that in which the nap is laid in order to disturb it as little as possible. After drying the goods are examined for imperfections, knots, etc., brushed well and run through the press, face to the bed.

LAYOUT.

1,564 ends; reed 11½—2 = 68" + 1½" for listing = 69½" over all.
28 picks.

CALCULATIONS.

1,564 ends 2½ run = 6.256 oz. + 7% .....= 6.694 oz.

28 picks = $\frac{28 \times 69\frac{1}{2}}{250}$ .....= 7.784 oz.

Loom weight ..... 14.478 oz.

STOCK MIXTURE.

50% wool @ 40c. per lb.....= $ .20000
50% mohair noil @ 36c. per lb..= .18000

Cost per lb. .....= $ .38000
Cost per ounce .....= .02375

COST.

14.48 oz. + 20% shrinkage = 18.1 oz. @ $.02375 .....= $ .4299
Manufacturing .....= .2850

Mill cost ..... $ .7149

The novelty fabric here illustrated is a double cloth having for its face a zibeline with an ordinary woolen cloth for the back. The process of manufacture is practically the same as for the piece-dye zibeline in

LAYOUT.

2,520 ends; reed 9—4 = 70" + 1½" for listing = 71½" over all.
28 picks.

CALCULATIONS.

840 ends 2/36 cotton = .89 oz. + 10% take-up .....= .98 oz.
1,680 ends 1¼ run = 13.44 oz. + 10% take-up .....= 14.78 oz.

28 picks 1⅜ = $\frac{28 \times 71.5}{137.5}$ .....= 15.28 oz.

Loom weight ..... 31.04 oz.
Finished weight 24 oz.

COST.

.98 oz. cotton + 5% waste = 1.03 oz. @ 32c. .....= $ .0206
15.03 oz. mohair mixture + 20% waste = 18.8 oz. @ 34.8c.....= .4080
15.03 oz. woolen mixture + 20% waste = 18.8 oz. @ 36.5c.....= .4287

$ .8573
Manufacturing .....= .2856

Mill cost $1.1429

MOHAIR MIXTURE.

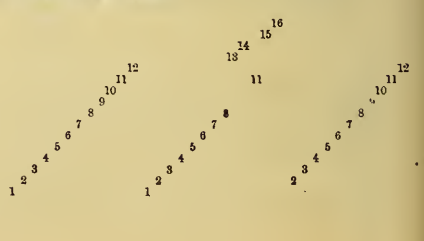
40% mohair noils @ 32c.....= $ .128
20% wool @ 40c. .....= .080
40% crossbred noil @ 35c.....= .140

$ .348

WOOLEN MIXTURE.

30% wool @ 40c.....= $ .120
70% crossbred noil @ 35c.....= .245

$ .365



the foregoing analysis, the chief element of difference in the two fabrics being the construction. The yarns used in the face of the double cloth are of the same mixture as used in the single cloth, and the yarns for the back are made entirely of wool. In the construction of fabrics of this type having the face and back of strongly contrasting colors, it will be found necessary to unite the two cloths by means of an extra warp in order to avoid having the back show through on the face, as would be very apt to occur if the back warp was interlaced with the face. The extra warp may be of worsted, as is customary with high-priced cloths, or of cotton, and should be interlaced in such a manner as to avoid having the interlacing form a pattern that is discernible on either side. In the cloth here described the stitch warp is of 2-36 cotton interlaced on a satin plan which hides it effectually. The stripe effect on the face of the sample is obtained by reversing the weave on two of the warp threads face and back, throwing the back to the face and vice versa, giving a clean cut stripe of the contrasting colors.

The particular pattern here described would be the most expensive of the range, as the white back will not permit of using any shoddy. In the darker colors the stock for the back warp and filling can be manipulated so as to reduce the cost materially.

FANCY BACK PRUNELLA

This is one of the modern variations of an ancient and well-known cloth, one possibly as familiar to our grandmothers as the serge is to the present generation. In recent years this fabric has had but little vogue as a costume cloth and has been used to a great extent for shoe tops. Its name is derived from the French prunelle, a plum, presumably from the color it most commonly bore in early times. Some years ago it was a much esteemed fabric, and was used for many purposes which in these times require a much finer fabric of higher texture and more expensive construction. It possesses wearing qualities that surpass those of many more expensive cloths and is warm without being bulky. The example here described is made with worsted face warp and filling, with a two-ply cotton back in stripes one-sixth of an inch wide, alternate black and white. The weave employed is the seven-harness satin for both back and face, one being the reverse of the other. In a construction of this kind it would be perfectly feasible to use a cotton filling also, as the weft is entirely concealed from view by the close texture and clever interlacing of the warp. The goods may be woven in the grey and piece dyed by a selection of dyes that will not stain the cotton while coloring the worsted threads, and is the method usually used, as it retains the waste in the white, a much more valuable form of by-product and one more readily salable than is colored thread waste. The yarns used for the face warp are not of fine grade, nor particularly fine counts, the stock used being a

Three-Eighths Blood Missouri Fleece

spun to 2-40s for the warp and single 36s for filling. The apparently great discrepancy in texture does not result in such a poorly-balanced cloth as might be supposed, but has a tendency to accentuate the desired characteristic of the fabric, that is, to make it a more decided warp cloth, if that be possible. In fabrics of high texture, both in warp and filling, the prunella becomes practically a repellant, and is susceptible of being made waterproof with comparatively little treatment. Its fine, close, smooth surface renders it a particularly useful fabric in the manufacture of shoe tops and gaiters,

and for these purposes there is no type of cloth manufactured which will give the same service for the price. With warp yarns made from long-staple wool that has received careful treatment in all the processes of manufacture the fabric will give such long service that one will readily understand the derivation of one of its common names, "everlasting."

In the finer grades the warps are made from 2-48s half-blood stock, with a relatively higher texture, and the filling is made from combed Sea Island cotton, making a fabric that is extremely fine with a soft, firm face and wearing qualities that are hard to excel. The manufacture of these goods is not attended with any particular difficulty and should show good profits. The comparatively high texture of the weft has a tendency to reduce the production to a certain extent, although this is overcome somewhat by the fact that the cotton back-warp improves the weaving considerably. To secure the best possible results

It Would Be Well To Size the Warp,

particularly if the yarns are flyer-spun, as there will be a much less breakage of the warp yarns in weaving, a material aid in obtaining production, and also will save a considerable amount of time and expense in the subsequent finishing operations, especially in the sewing and mending departments. In several of our leading department stores the fancy back prunella is offered for suiting purposes, and is said to be meeting with no little success as a fabric for automobile wear in the chilly days of early fall, before it becomes necessary to don the heavier mackinaws and furs that have become the usual garments for cold weather riding. As an outer coat it is warm, not bulky, and can be easily tailored into a variety of styles not possible to attain with fabrics more clumsy in construction. The fancy back gives the tone so much desired in garments for this purpose and the close face does not hold the dust which so readily accumulates in the rougher faced cloths. The process of manufacture is similar to that employed in the production of clear-finished men's wear fabrics. The greater portion of goods of this type are manufactured by mills having the necessary machinery for

Spinning Their Own Worsted Yarns,

a very considerable saving in the cost of production. The majority of such mills purchase much of their wool directly from the grower, thereby effecting a saving of the profit usually taken by the dealer, and giving them a decided advantage over the mill with a limited capital, which must of necessity buy in smaller quantities, and, in many cases, at a considerably higher price. In times of hard competition it is the small savings of this sort that make up the greater portion of the limited margin of profit it is possible to obtain. The mill equipped with an up-to-date spinning plant in connection with its weaving machinery is in much better position to fix prices than its competitor that must purchase yarns in the open market, paying the spinner a profit over his fixed charges and operating expense. In making yarns for this class of fabrics it is not necessary to sort the wool as closely as would be the case in manufacturing yarns for men's wear, in fact, in some dress goods mills the graded fleeces are made into but three sorts, or two sorts and the skirts. The shrinkage of these wools is light, as is the per cent of noil made. In scouring, it is essential that there should be nothing but pure materials and soft water used. The use of

Soda Soaps Is Not Advisable,

although it is very true that the action of soda compounds is not nearly as harmful on low-grade wools as it is on the finer staples. The scouring liquor should be prepared by first boiling the detergents to be used in a suitable tank that they may be dissolved and thoroughly mixed. This makes a stock solution from which the scouring liquor may be made up with ease

and accuracy. A very satisfactory formula for the stock tank is eight ounces of soap and four ounces of alkali per gallon of water. In preparing the scouring liquor in the wool-washing machine use four gallons of the stock solution to each hundred gallons of water; if additional alkali is indicated, it should first be dissolved in warm water then added to the bath. The second and third bowls of the machine should have less of the stock solution and the fourth bowl a very weak bath.

It is very essential that the detergents used contain no free caustic alkali, as this has a very injurious effect on the wool fibre. It may be that exception will be taken to the use of a soap liquor in the final bowl of the scouring machine, but many years' experience has amply proven that wools for worsted combing should not be rinsed in clear water, as is the custom with clothing wools. The light amount of soap carried by the fibre acts as a lubricant in the subsequent process of carding. The amount of noil made in combing stock of this grade should be very small, not over ten per cent at the most, and the entire shrinkage from clean wool to top should not exceed 12½ per cent. In the further processes of manufacture it will be necessary to use good judgment as to draft, and care must be taken to see that the top rolls are in good condition. A great many of the imperfections in worsted yarns are due to defective top rolls, a slight unevenness here allowing the sliver to pass through without being acted upon in the proper manner, causing a bunch or slug that must be removed later with attendant labor and expense.

In no part of the process of manufacture is there a greater exemplification of the truth of the old saw that "an ounce of prevention is better than a pound of cure." The rolls on every machine should be examined at least twice daily, those that are imperfect being removed and replaced with newly-covered, smooth rolls. This may appear to be a small item, a "mere trifle," but it is strict attention to these

Trifles that Bring the Perfection

which should be the aim of everyone from bobbin boy to manager. The spinning and twisting of the warp yarn should be followed by a rigid inspection of the finished yarn before it goes to the spooler. The removal of defects here may mean the saving of allowances on the finished goods, and is effected with much more ease while the yarn is free than when woven tightly into cloth. Especial care should be given to the roving frames, reducers and spinning frames used in the production of the filling yarns, as these are used direct from the spinner bobbins, allowing no opportunity for inspection or removal of imperfections before they are in the woven goods.

The dressing is done on a dry frame, preferably, as the time gained in this way is a considerable item, the sizing on the slasher not only taking much less time but also being much more even, giving better results in the weave room in the way of production and even warps. The equipment of the looms with some form of

Warp Stop Motion Is Strongly to be Recommended,

as it allows the weaver to devote practically his whole time and attention to the filling and guarding against defects of various kinds. It may be said that there should be no necessity for such an appliance, but it is a device that will soon repay its cost in increased production and practical elimination of long threads out, which are a source of no little expense in the finishing department. The burling and sewing are not difficult, but should be performed with care, every knot raised both sides of the goods, threads out sewed in and slugs reduced or replaced with perfect yarn. In using single filling it must be well conditioned before attempting to use it in the shuttle or there will be a great deal of trouble from succeeding picks looping round the loose thread between the listing and the shuttle box, drawing the

doubled thread into the shed, a very common form of imperfection. The means of preventing this usually in vogue are either steaming the yarn to set the twist or a hot-air treatment which gives approximately the same result. The use of

Heavier Brushes in the Shuttles

is not to be recommended, as this places an undue amount of tension on the yarn and has a tendency to make the goods have a "teethy" appearance, as well as being a prolific source of broken picks, a form of imperfection which should be eliminated if possible. In scouring, it should not be necessary to use a strong soap, as the goods contain very little in the way of impurities aside from the slight amount of oil, applied in the yarn making, and the size used in the dressing room. A pure palm oil soap fortified with a sufficient quantity of pure alkali to saponify the oil contents should give very satisfactory results. The use of a strong alkali soap is not only unnecessary but absolutely harmful in the extreme. In fact, the use of harsh alkali in any process of woolen or wortsed manufacturing is inexcusable and should not be allowed under any circumstances. Before dyeing, the goods would be much improved by a run through the

Continuous Crabbing Machine,

a process which will put the goods in much better condition for subsequent operations and remove the danger of wrinkles showing in the finished goods. If the treatment of the pieces in the wet finishing has been what it should be in every particular, it is not at all likely that the dyeing will be attended with any difficulty. The most prolific source of shady goods is the wet finishing department, not the dyehouse, as so many of our superintendents and managers seem to think. The pieces should be run into a kettle large enough to hold them without undue crowding with sufficient water to submerge the entire quantity of goods, aside from the portion necessarily lifted from the bath during its passage over the reel. If care is taken to have the piping so arranged that the heating of the bath is practically alike in all parts of the tub the results should be as nearly perfect as it is possible to attain in this world of imperfections.

In case it is necessary to add dyestuffs to procure the shade desired, the bath should be allowed to cool or the results will be far from satisfactory. The tales of shading colors that may be safely added at the boil should not receive too implicit confidence, or it may be that there will be a sudden change of dyers as a result of such faith. Even with the best of drugs and the greatest care there are poor results at times, and no chances should be taken that are avoidable. In making a test for shade it is

Advisable to Dry the Sample

and run it through the press before matching, so that it may have as nearly as possible the same treatment as was accorded the reference sample in the limited time at the disposal of the dyer. The necessity for this is readily appreciated by anyone who is familiar with the change in appearance of many colors during the finishing process. Should the shade prove satisfactory, the pieces should be cooled off, thoroughly rinsed, extracted and dried. The operation of drying is usually accomplished by means of artificial heat in some form of drying machine, one of the most approved being the horizontal chain dryer, with low feed and attachments that enable one operative to attend to the feeding of the cloth.

The selvages of the goods are engaged by steel or brass pins set at intervals of about a quarter of an inch in the links of endless chains which carry the goods between steam-heated coils, thus hastening the drying, while the goods are tentered by the chains which are held at a fixed distance apart by means of suitable guides and sprockets. If necessary to increase the output of the dryer, it is advisable to add a section rather than to increase

the heat, as excessive heat has an injurious effect on the wool fibre. The dry pieces should be brushed, sheared both sides, brushed a second time, inspected, any damages that are found repaired, sprayed, and are then ready for the press. The press should be hot, not merely warm, and not speeded too high. The finish resulting from too high speed of the press is very evanescent, and a second run will be necessary to secure permanent results, entailing a waste of time and additional labor. Allow the pieces to cool off on the rolls, spray, inspect and roll up. Goods so treated will have a finish that will remain for a considerable length of time, and will not water spot.

LAYOUT.

10,528 ends; reed 16—10 = 65.8" + 1½" for listing = 67.3" over all.
70 picks.

Dressed:
16 × { 1 2/40 white worsted.
1 2/48 white cotton.
16 × { 1 2/40 white worsted.
1 2/48 black cotton.

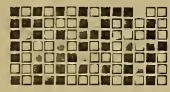
CALCULATIONS.

5,264 ends 2/40 worsted = 7.52 oz.
+ 5% take-up .....= 7.900 oz.
5,264 ends 2/48 cotton = 4.18 oz.
+ 5% take-up .....= 4.389 oz.
70 pks. 1/32 wstd. = $\frac{70 \times 67.3}{(32 \times 560) \div 16}$ = 4.260 oz.
Loom weight ..... 16.549 oz.

COST.

7.9 oz. worsted + 5% waste = 8.29 oz. @ 84c. per lb.	=	$ .445
4.389 oz. cotton + 5% waste = 4.6 oz. @ 40c. per lb.	=	.115
4.26 oz. worsted + 3% waste = 4.39 oz. @ 78c. per lb.	=	.214
Cost of stock		$ .774
Manufacturing, 70 picks	=	.375
Net mill cost		$1.149

FRONT.



WORSTED DIAGONALS

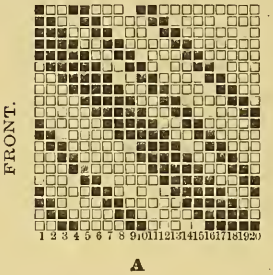
Diagonals, or wide wales as they are frequently termed in the trade, have been extremely popular with the cutting-up trade for the past two seasons. They are developed both in piece-dyes and fancies for men's wear and dress goods in a great variety of colors and weights. Their manufacture requires no special equipment unless it is desired to produce styles which need more harnesses than are to be found available in some of our mills. Many of the recent additions to the weaving equipment of our worsted mills have been

Thirty-Harness

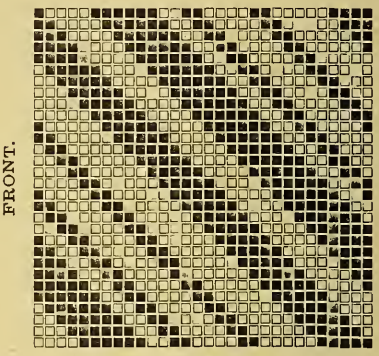
looms, and with this type of machinery the designer will be able to produce an extremely varied line of diagonals. The fabrics vary in texture somewhat from the ordinary fancy worsted, there being a seeming disproportion between the threads of warp and filling, the warp having a relatively low number of ends with a higher number of picks for the same weight. The expense of manufacturing this type of fabric is somewhat higher than the ordinary twilled worsteds for two reasons: First, the cost of weaving is increased on account of the higher filling texture, and production is smaller, which naturally increases the overhead charges per yard. By means of combination twills the designer is enabled to produce diagonals on the ordinary harness loom that apparently require a jacquard loom for their manufacture. The method of procedure for manufacturing this class of diagonals is not intricate, and should be familiar to every designer on worsteds for men's wear or dress goods. A single example should be sufficient to make the principle so clear that there will be no difficulty in working out a great variety.

For use in our illustration we have selected a twill complete on 20-har-

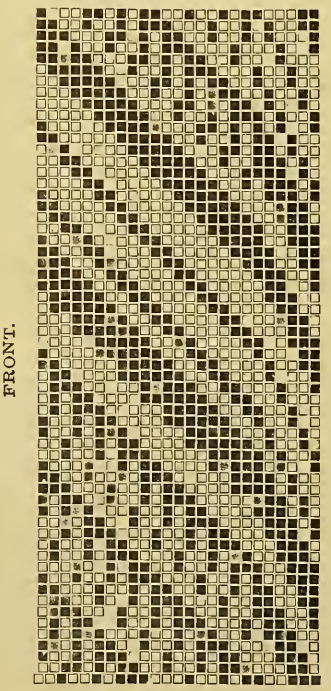
ness A and one repeating on thirty-harness B; each will repeat evenly on sixty bars. In making the combination twills we use the first warp end of A, the second of B, third A and fourth B, proceeding in this manner until we have used every alternate end in each chain. By cross drafting they are reduced to a working basis in chain C, and the accompanying drawing-in draft:



A

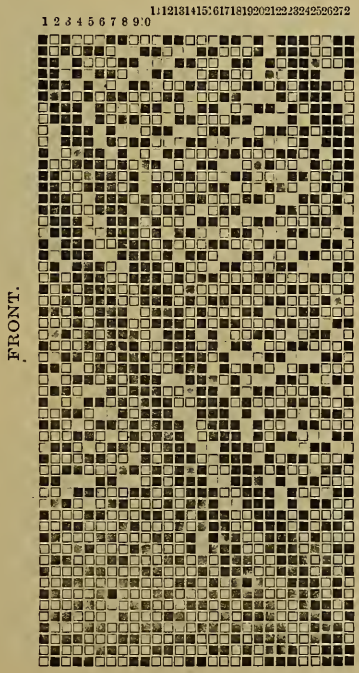


B



C

A serpentine effect in diagonals may be easily obtained by drawing part of the warp threads two on one harness, which will give the same wavy appearance as would be produced by the use of a combination of a 63-degree twill with one of 45 degrees. The style for which the chain is here given may be developed in piece-dyes or with warp and filling of contrasting skein-dyed yarns or mixtures. If good taste is used in the selection of colors, the result will be a very pleasing effect. The yarns used are 2-40s half-blood in two shades of brown mix, the warp dressed with 4,500 ends of the darker mix, the lighter shade being used solid for the filling, 74 picks per inch. The ends are drawn straight on 28 harnesses.



D

Another series of patterns may be made with solid warp and two or three colors of filling, which give some very nice suiting styles, full particulars for such an arrangement following. With a little ingenuity the designer will be able, by aid of these suggestions, to develop a very creditable line of styles. The layout here given is for a diagonal drawn straight on 20 harnesses:

LAYOUT.

4,600 ends 2/40 black; reed 14—5 = 65.7"
+ 1.3" for listing = 67" over all.
88 picks per inch.

Filling:
1 maroon.
8 brown.
1 maroon.
14 black.

24 picks.

CALCULATIONS.

4,600 ends 2/40 = 6.57 oz. + 10% take-up ..... = 7.22 oz.

88 picks = $\frac{88 \times 67}{40 \times 560 \div 2 \div 16}$ ..... = 8.42 oz.

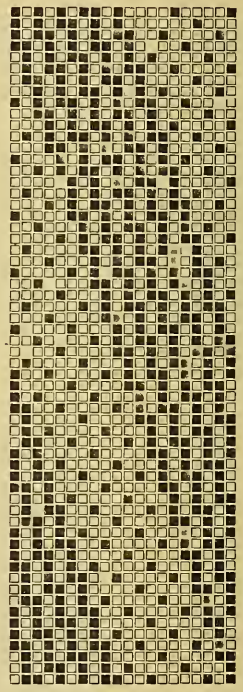
Loom weight ..... 15.64 oz.
Plus 7% waste ..... = 1.17 oz.

16.81 oz.

COST.

16.81 oz. @ $1 ..... = $1.050
Manufacturing ..... = .514

Mill cost $1,564



FRONT.

E

CHINCHILLA

The chinchilla is a fabric especially adapted for use as an overcoating. It is made in a variety of weights and colorings with solid color or fancy backs. The present season's demand for the heavier weights in men's overcoatings is largely for goods with plain backs, while for ladies' wear the fabrics are somewhat lighter in weight with plaid backs predominating. The manufacture of these cloths is a very large factor in the business of several of our mills, and by their policy of keeping their deliveries up to a high standard of excellence have succeeded in building a reputation on their special cloth which is an extremely valuable asset.

A glance over the offerings for the present fall season reveals an apparently endless array of colors, weights and prices. From the very bulky

three-ply cloths in expensive fabrics suitable for the severest winter weather, the weights and prices range down the line to a comparatively light-weight single cloth in three-quarter width, made by a concern whose output but a short time since was the humble but very useful satinet. The fact that the majority of chinchillas are made in weights of from twenty-four to thirty-six ounces gives the skilled manipulator of stocks an almost unlimited opportunity to use his knowledge. Many of the fabrics are made with wool for face and back, with a considerable part of the weight added to the goods by means of a third cloth between these two that does not show in the slightest degree on either side. It is one of the most desirable and satisfactory cloths that has yet been produced for overcoating and cloaking purposes. While not extremely difficult to make by those accustomed to its fabrication and finishing, there are many manufacturers who have failed in the attempt to produce a satisfactory cloth.

There are few fabrics which change their appearance during the finishing as much as does the chinchilla. As it comes from the loom it is a coarse, thready cloth, with a face that is flat and somewhat loosely woven. With the proper machinery, under the direction of a skilled finisher, a transformation takes place that is but little short of marvelous. The only

Special Machinery

required for the manufacture of these cloths is in the finishing room, the one machine without which the making of chinchillas is impracticable, if not an utter impossibility. It can also be used for the production of other types of finish, the stock used varying with the price of the goods and also to a certain degree with the finish wanted, that is, the size of the "nub" or spiral. The face must have sufficient staple to form a thick, long nap in the gigging operation without loosening the fibre from the goods. The stuffing and back may be of relatively cheaper material, except in the case of plaid backs of fine texture, which will require comparatively fine spun yarns and stocks suitable for their manufacture.

The sample selected for analysis is a solid mixture, back and face the same color and stock, the shade being obtained with 10 per cent white and 90 per cent black. To get an even distribution of so small a percentage of white in the mixture will require more than ordinary care in the picking. The best method to pursue in making mixtures of this kind is to first mix the white with an equal amount of black, running it twice through the picker, then proceed in the usual manner, using four times the quantity of black for the alternate layers with one part of the black and white mixture. Goods of this character need comparatively little

Burling and Mending,

the heavy nap required for the nub effect in finishing obscuring the weave entirely, and threads out or broken picks will not be noticed in the finished cloth. The fulling will not be a lengthy operation, as the goods are loosely woven and will felt easily, but a good soap must be used, one that will retain its life during the fulling and will scour out readily. After washing, the pieces should be well extracted and taken to the gig or wire napper. The napping operation is carried on while the goods are damp, because the wool when moist is more soft and flexible. In this condition it is possible to raise the nap with less waste of stock than can be done in dry napping. When the nap is sufficient for the desired finish, the goods are dried in the usual manner and taken to the curling machine. This is the principal feature in the finishing of chinchillas.

The essential parts of the machine are two beds, between which the cloth is drawn. The lower bed is usually covered with Brussels carpet, the lower face of the upper bed, the rubbing surface, being covered with rubber. By means of eccentrics on the verticle shaft a rotary motion is imparted

to the upper bed which curls the nap into spirals or nubs. The size of the spirals may be changed to a certain extent by increasing or decreasing the throw of the eccentrics. The goods require no shearing or pressing in the majority of cases, although occasionally the pieces are cropped to regulate the length of the spiral. In the sample here described the face and back warps have the same number of threads in each and they are of the same size. In plaid-back goods it will oftentimes be found that the back cloth has a texture double that of the face in order to secure a fine, neat looking cloth which will take the place of a lining in the garment. Usually the face and back are united in such a manner as to allow the two cloths to be separated without much trouble, so that for trimming lapels, cuffs, etc., the cloth can be reversed and the face cut away, making a less bulky and very neat finish. This is ordinarily accomplished by the use of an entirely distinct system of warp ends, usually termed the stitching warp, and is generally of worsted for the better grades of goods.

LAYOUT.

3,600 ends; reed 12½—4 = 72" + 1½" for listing = 73½" over all.
36 picks.

CALCULATIONS.

3,600 ends 2¼ run = 16 oz. + 10% take-up .....= 17.60 oz.

36 picks 2¼ run = $\frac{36 \times 73.5}{225}$ .....= 11.48 oz.

Loom weight ..... 29.08 oz.
Finished weight 23-24 oz.
Finished width 56".

COST.

60% wool @ 40c. .....=	24.0c.
40% shoddy @ 16c. .....=	6.4c.
Cost of stock per pound.....	30.4c.
29.08 oz. + 20% waste = 36.3 oz. @ 30.4c. per lb. .....=	$ .6897
.6897 + 5% shrinkage in finishing =	$ .7240
Manufacturing, 36 picks + 5%...=	.3680
Net cost	$1.0920

One of the most popular of this type of fabrics is the

Cut Chinchilla,

now showing in a range of bright colors suitable for sport coats as well as in a line of mixtures and solid shades for men's wear. The "cut" or striped effect is produced by dressing in the warp at regular intervals threads of cotton or other hard-twisted yarns, which are so interlaced with the filling as to bind it closely to the face of the fabric and prevent the formation of the floats necessary to produce the long nap formed into nubs by the action of the chinchilla machine. The larger part of these cloths are of double cloth construction with fancy backs, making a pleasing contrast to the relatively plain face. From the layout and drafts given as examples of the plain-faced chinchilla the designer will have no difficulty in laying out any number of styles in plaid or plain-backed goods. It is very essential that the fundamental idea be kept in mind, that is, stock long enough to form a long, full nap interlaced in such a manner that the napping machine can tease out the fibre without injuring the structure of the fabric.

ALL-WOOL THIBETS

During the period of its popularity the thibet was a much abused cloth. It was made in almost all conceivable qualities, and many of the fabrics were more like cheviots than thibets, owing to the fact that many manufacturers

were tempted to make a thibet cloth, and as they were not experienced in such materials they used too coarse wools and shoddies, the consequence being that their cloths were not felted and gave a raw and thready appearance—a "raw cloth" with a finish even more "raw," and any garment made up from such a fabric could not be kept clean. It seemed as though it had a strong affinity for all the dust and lint in its vicinity, which stuck to it like a burr, and resisted all efforts to brush it off, for which reason it soon lost its popularity, as hardly anyone would buy a second suit of thibet cloth.

A properly-constructed thibet, having the right quality of stock and finished correctly, will not show the above defects, but can be kept as free from dust and lint as a fine undressed worsted. The writer has seen critical buyers testing thibet cloths by crushing a quarter of a yard in their hands and then throwing it on the floor, giving it all possible opportunity to get covered with dust and lint, then shaking the sample to see how much of the dirt still remained sticking to it. The fabric which emerged in the cleanest state after such treatment was usually adopted as a standard of finish.

In the quality of stock used and in the manufacturing processes it is very similar to a melton cloth in that it requires a good felting wool that will felt down into the bottom of the cloth and make a smooth, soft face. Let the wool or the shoddy get the least trifle coarse and it will "hair up" on the face instead of felting down, and the result is more like a cheviot or a mongrel cloth, and it was these mongrel cloths that spoiled the trade in thibets. A thibet cloth requires considerable fulling both in length and width, but care should be taken that it does not become too solid and boardy, as the finished cloth should handle "clothy" but without any "bone" to it.

It should also show an indistinct twill effect, or, as it is called in England, a

"Blind Twill,"

meaning indistinct like an undressed worsted. In this it is dissimilar to the melton cloth, which should not show any twill or weave effect. Hence the weaves used in meltons are those which produce a smooth, plain face, while the ones usually selected for a thibet are those which show an indistinct twill, as previously noted. It is true that some light-weight thibets are made in a plain weave, but they are made so with a view of cheapness, as larger yarns can be used and consequently more shoddy and fewer picks per inch, thus yielding a larger production with decreased overhead expenses.

All-wool goods of this fabric, that is commercially all wool, require to be laid wide in the loom, usually for shoddy mixtures 80 to 84 inches wide in the reed, while the cotton carded mixtures are laid narrower, according to the proportion of cotton in the mixture. It requires considerable experience in fulling to know just how wide to lay such goods, as everyone knows that there are no fulling properties in cotton, and if laid too wide and the finisher attempts to force the fulling in order to get the pieces up to the required width the result may be disappointing, as the fabric will handle stiff and boardy. The width for setting cotton mixtures in the reed is largely a matter of experiment, as it is hardly possible to determine beforehand the fulling properties of the shoddies, and then again the amount of twist in the yarns is a great factor in fulling.

In former articles on similar heavy fulled cloths we have mentioned that it is necessary to use a good heavy-bodied soap in the fulling, having sufficient free alkali to overcome any acid that may be left in the shoddy stock through lack of proper care in neutralizing. The soap must also be strong enough to saponify the oils used in oiling the stock at the picker room, for unless there is a thorough saponification of all grease or oil in the goods

there cannot be proper fulling and felting of the cloth. In addition to all the above, it is desirable to avoid any

Extreme Heat

during the fulling process, because if the goods become too warm they will shrink quickly without getting the necessary felting. A temperature that is just warm to the hand is about right, and the moisture—soap solution—should be so that when you take a part of the cloth and wring it hard in your hands the soap solution will show up on the surface of the cloth.

When the fulling is completed, time should be given for a gradual cooling of the fabric, and in as open a state as possible, because if allowed to lie in a heaped condition between the fulling and the scouring there is danger, especially in warm weather, of a slight degree of formulation, which should be avoided. Warm water should always be used at first when washing off the fulling soap and dirt, which is now in a loose condition, and a good rinsing with warm water will free the goods very quickly. It will be necessary to give them another soaping, and if clean the suds will show up white and the soap foam will almost fill up the washer bowl. After this second soap bath is rinsed off it is a good plan to use a few pails of a solution of monohydrate soda standing 2½ per cent Twaddell, or carbonated ammonia solution.

Some finishers prefer to use a few quarts of aqua ammonia, as it is easier to handle. One alkali is as good as another, and a finisher can use whichever he finds the most convenient. The object in using this alkali solution is to raise and emulsify any residue of soap not washed out in the previous rinsing, and insure the goods being thoroughly clean. Wash off this alkali with warm water, and use cold water for the final rinsing, which will set or solidify the cloth.

Carbonizing.

This process is for the purpose of destroying all vegetable or other foreign matter in the goods, which if left in the cloth would show up as "specks" and necessitate the tedious process of specking by hand, that is, picking out every little speck of foreign matter by the use of pincers which are made like sharp-pointed tweezers. This is a slow and expensive process, but by the use of chemicals in the soaking tank and the necessary heat in the carbonizing machine all vegetable and foreign matter is completely destroyed. The soaking tank should be lined with lead, the hydro-extractor basket made of copper, and all metal parts both inside and outside of the extractor sheet should be coated with paraffine or shellac, otherwise the carbonizing acid would soon destroy the iron.

The operative should be supplied with rubber gloves and apron, as the acid eats its way into almost everything with which it comes in contact, and should be handled with care. The acid or wet process is usually used in carbonizing piece goods. A bath is made up in the soaking tank with water and sulphuric acid to test about 4½ degrees B., and the goods are allowed to remain in the tank until thoroughly saturated. They are then put through squeeze rolls, the liquor running back into the tank. then extracted and run through the baking or carbonizing machine at 200 degrees Fahrenheit, which effectually destroys all burrs and foreign matter. Many mills do not have a baking machine, but hang the goods up in a baking room, which is heated to the necessary temperature. After baking, the goods should be run in a dry fulling mill, which will break and pulverize all the vegetable matter into a fine dust.

Dyeing.

After dyeing to shade and given a good rinsing the goods should be run in a solution of Fuller's earth. This is a peculiar kind of clay which has been used for many years in the finishing of fine woolens and worsteds. It

has great cleansing properties and has a softening action on woolen goods. It is used in nearly all fine piece goods mills to remove all traces of loose dyestuffs, and prevents crocking or sutting, which is frequently found in the cheaper grades of piece-dyed fabrics. It is cheaper to use and much superior to soap, as it will not mat or felt the fine nap the way that soap is very apt to do.

There are many finishers to-day who have never used this earth, and therefore know nothing of its softening and cleansing properties, but it is much appreciated by all who have ever used it, especially the refined article, which is much preferable to the crude earth. No one should attempt to use more of the earth than the water will hold in suspension without frequent stirring. A good proportion to use is two pailfuls of the refined earth to a barrelful of water, and allow six pails of this solution to four pieces of goods, run from 20 to 30 minutes and then rinse off in cold water.

After being extracted the pieces should be rolled up on a roll under heavy pressure and allowed to stand for at least 24 hours. This "feeds" the cloth, giving it a more mellow handle. Regarding

Moisture in the Wool,

whether after scouring in the raw state or after being made up into cloth, is a process that is not given sufficient attention in the average mill, but everyone who has given any consideration to the subject knows that wool after being subjected to the action of alkalies and the heat in drying should be stored in a moist, cool room for a few days to allow it to regain its normal condition before being put through the picker. Such wool will card better and spin to finer counts with less manufacturing waste than similar wools not so conditioned. Most mill agents and treasurers are so anxious to get the goods finished up and into the market that they will not listen to any suggestions of letting goods lie for a day extra on the rolls. It is "push and

Layout for 12-oz. all-wool thibet:

2,560 ends; 10½—3 reed = 81½" inside listing + 1½" for listing = 83" over all.
Warp yarn 4¾ run, left twist.
Filling yarn 5 run, right twist.
Weave 3 harness, twill to right.
40 picks.

CALCULATIONS.

2,560 ends 4¾ run = 5.40 oz. + 8% .....=	5.83 oz.
83" × 40 picks 5 run = 6.64 oz. + 8% .....=	7.17 oz.
Loom weight	13.00 oz.

Finished weight 12 oz.
Fulled to hold 8% in length.
13 oz. yarn + 10% manufacturing waste = 14½ oz. of stock at picker.

14½ oz. stock @ 50c. per lb.....=	$ .4406
Plus 8% shrinkage in length.....=	.0355
Cost of stock	$ .4761

Manufacturing cost and charges:

2-loom work .....=	.2600
Plus 8% .....=	.0208
Mill cost	$ .7569

Layout for 12-oz. cotton mixture thibet:

2,240 ends; 9—3 = 83".
Listing to be taken out of warp.
30 picks.
Warp yarn 3½ run, left twist.
Filling yarn 3¾ run, right twist, spun soft.
Weave 3 harness, twill to right.

CALCULATIONS.

2,240 ends 3½ run .....=	6.40 oz.
83" × 30 × 3¾ run.....=	6.64 oz.
	13.04 oz.
Plus 10% .....=	1.30 oz.
Loom weight	14.34 oz.

Finished weight 12 oz.
14.34 oz. + 10% waste allowance = 15.93 oz. of stock at picker.

Stock mixture, warp and filling:

20% carded cotton @ 18c. per lb..=	$ .0360
35% fine wool @ 50c. per lb.....=	.1750
15% fine mill waste @ 12c. per lb..=	.0180
30% fine thibets @ 18c. per lb...=	.0540
Cost per pound	$ .2830

16 oz. of stock = $.2830 + 10% shrinkage in length .....=	$ .3057
Manufacturing cost: 2-loom work = $.229 + 8%.....=	.2510
Mill cost	$ .5567

push," quantity first and quality second, and as long as the goods are sold and they get their price what more is necessary?

Dry at a moderate heat, as too high a temperature in drying will undo all that has already been accomplished to soften and mellow the cloth, especially if the mill is compelled to use hard water in the finishing processes. After drying, steam brush well to raise and soften the nap or felt, shear to cut off all long fibres, to level the nap and close enough so that the nap will not rough up. Steam brush again and dampen with a dewing machine. Press at a good pressure, giving it a little steam to soften the face before rolling up on the press rolls.

In the finishing of cotton mixed thibets it is advisable to give a steam finish to the goods previous to dyeing, or it can be done after dyeing, whichever is the most convenient. The steam finish will give an added luster to the goods and overcome any tendency of the cotton mix to show dead or lack luster so common to cotton carded goods. This steam finish is given by rolling the goods onto a perforated copper cylinder and blowing steam through the goods for 15 minutes while the cylinder is kept revolving, then forcing cold water through to thoroughly cool off. This operation is repeated on a second cylinder in order to even up the different ends of the cloth. This steam finish is described more fully in other articles on broadcloths and kerseys.

EPONGE

This type of fabric is one which derives its novel appearance entirely from the yarns of which it is constructed. Were it made from plain yarns, instead of being a high-priced novelty worthy of a place in any lady's wardrobe, it would be a loose, sleazy cloth with an appearance more nearly like burlap and of comparatively no value. During a season when goods of this character are in active demand, there should be opportunities for mills equipped with the necessary twisting machinery for production of such yarns as enter into these fabrics, to earn exceptionally good profits. Aside from the yarn manufacture, the production of these novelties shows no difficulties whatever that are not present in as great, if not greater, number in manufacturing the more staple fabrics which show a great deal smaller profit per yard or per loom. In order to make the

Greatest Possible Profit

on fabrics of this nature, the manufacturer should have a plant for the spinning of his own yarns from the grease wools. By so doing he is able to add the spinner's profit to that of the weaver as well as paying a reasonable interest on the extra capital invested in the spinning mill. In addition to this feature, the fact that he may produce yarns of various kinds for experimental purposes at short notice is a very decided advantage. The ability to produce yarns that are different in appearance than those ordinarily shown by dealers is also an item in his favor, and at times he may produce a distinct novelty which will prove a free selling fabric at a price which will show a very handsome profit. It will take his competitors some time to follow with a similar cloth, as experiments must be made to duplicate the yarns, which spinners are not at all times ready to do, and will result in a considerable delay under any conditions. Meantime the market has been supplied at a good price by the originator, before competition by copyists has reduced the price to a point where there is very little profit to be obtained.

In order to be in the first rank, it is necessary that the designer of

the fabric and the maker of the yarn should be in very close touch with each other. In this way, by co-operation and experiment, it is possible to attain results that will give an individuality to the line of fabrics and secure a good volume of orders at prices that will be extremely satisfactory. The manufacturer who is content to follow in the beaten track and produce goods which, from force of circumstances, are practically duplicates of other lines will never be eminently successful.

The particular feature which differentiates the sample under discussion from the ordinary is the novelty yarn used in its construction. Instead of the usual eponge yarn with its more or less regular loops, this fabric is constructed with three ends of ordinary two-ply yarn and one end of a knot or slug yarn in the dressing pattern, with all ordinary two-ply yarns in the filling. The knot yarn is made with a two-ply core, about which is twisted a relatively coarse roving, which, by the intermittent motion of the knotting device, is made to form a bunch or slug at intervals of about two and a half inches, which is from three-quarters to one inch in length. These appear to be scattered somewhat irregularly over the surface of the cloth, and from their fancied resemblance to the embryo frog, have given the name

"Tadpole Eponge"

to the cloth. The eponge with which we are more familiar differs in construction from this in that it is composed entirely of the novelty yarns made on a looping twister. This machine has a second set of rolls which carry the thread with which the loop is formed. This set of rolls is driven by a separate train of gears and is capable of being driven at a speed greatly in excess of that of the rolls carrying the "core" yarn, or base upon which the loop is formed. In the manufacture of certain types of loop or "picot" yarns it is necessary that the loops should occur at regular intervals, and this is accomplished by a rail carrying fingers close to each thread, which receives an intermittent reciprocating motion from a cam driven by a belt from the cylinder shaft. In making the

Ordinary Eponge Yarns,

regularity of the loops is not essential, and the mechanism last described is dispensed with by most makers of these yarns. In order to prevent displacement of the loop by the friction of the reed in weaving, it is customary to twist a third thread about it, in the opposite direction, which acts as a binder. The core and binder are in many cases made from cotton, and do not materially affect the handle or appearance of the cloth. The dressing frame must be provided with coarse reeds or many broken threads will result from the novelty yarn catching in the reed if a fine one is used. In weaving it will also be found advantageous to use coarse reed, as it will aid very materially in increasing the production per loom and reduce the mending expense in the finishing room. Goods of this type require comparatively little finishing, as they are simply cropped on the shears. The scouring must be thoroughly done, or it may result in shady goods from the dyehouse.

LAYOUT.

896 ends novelty yarn; reed 7—2 = 64" + 1½" for listing = 65½" over all.
15 picks.

CALCULATIONS.

896 ends (3.000 yds. per lb.) = 4.78 oz. + 10% ..... = 5.71 oz.

15 picks = $\frac{15 \times 65.5}{3{,}000 \div 16}$ ..... = 5.24 oz.

Loom weight ..... 10.95 oz.

COST.

10.95 oz. + 10% waste = 12.17 oz.
@ $1.12 per lb. ..... = $ .8519
Manufacturing, 15 picks ..... = .1725

Net mill cost $1.0244

Four harness, straight draw.
Plain weave.

UNFINISHED PENCIL STRIPES

The popular preference for through and through cloths is largely due to the fact that when fabrics for the fall season were much heavier than are worn at present, it was customary to make the back and face of worsted, with a stuffing pick of less valuable material for the extra weight. As buyers became more versed in the intricacies of cloth construction, the desire for fabrics composed entirely of the more expensive materials became more prevalent, with the consequent result that they demanded a cloth having the back and face of similar construction, or as they are commonly termed, "through and through" cloths. The impression given the layman by many dealers in former times was that the cloths so constructed were of foreign manufacture, and therefore superior to fabrics turned out by any domestic mills. The injury done to the American manufacturer by such shortsighted policy on the part of the clothing dealer and tailor has been incalculable, and it has taken much effort and many years to correct the false impression given the public by stories of this kind, circulated by those who certainly should have known better. As a matter of fact, a very large percentage of the "foreign" goods handled by merchant tailors and high-class clothiers is the

Product of Domestic Looms,

the nearest approach to a sea voyage that the greater portion of them have ever had being the one-night trip on the Sound steamer, or the "voyage" across the North river. The radical decrease of weight during recent years, in both spring and fall fabrics, has resulted in many of the cloths being offered in single cloth construction. To the lay mind this term may have little significance, but to one at all conversant with fabrics and their manufacture, it indicates that there is but one system of warp and filling, the back and face of the cloth being identical, except that the twill on the back is the reverse of that on the face of the goods, and in some cases the pattern is not as clear, owing to various causes inherent to construction and manufacturing details.

In order to obtain the weight desired for fall fabrics in single cloth, it is customary to use much heavier yarns than would be necessary were the double cloth construction used, and, as a result of so doing, the texture of the cloth is materially reduced with a consequent increase in the size of the twill. The

Peculiar Feature

of the fabric here discussed is the fact that while it has all the earmarks of a single cloth, save one, it is made with two systems of warp with a filling common to both. The pattern on face and back is identical with the twill on one side the reverse of the other, but with an apparently much higher texture than would be expected in a single cloth.

This seeming paradox is the result of the weave used, the three-harness face and back, which is somewhat unusual, in connection with the comparatively heavy yarns used in the manufacture of this particular cloth. As a general thing, the three-harness weave is used in connection with fine yarns of good quality and in fabrics of relatively high texture, resulting in a cloth with an extremely fine smooth face, and usually developed in a line of nice colorings in neat effects. The fabric under discussion is made from rather heavy yarns of not particularly good grade; the stock used being apparently about a three-eighths blood from some of the bright fleeces, probably a Missouri, and spun to 2-24s both warp and filling. In this particular cloth both yarns are spun on the Bradford system. As the fabric is "unfinished," an effect which possibly would be superior in appearance, though an inferior cloth would result, might be obtained by the use of a single filling spun on the French system. By so doing it would

be possible to make a cloth with a slightly improved handle, but the strength would not be equal to that of a cloth made from two-ply yarns in both warp and filling. In many mills it is the custom to use single yarns for filling in a large proportion of their product, chiefly because of the saving in spinning expense of the relatively large single yarn, over that of producing two threads of practically half the weight, which must be doubled and twisted to form the finished thread. This method is used both for the manufacture of light and heavy weights in piece-dyed cloths, but is not as commonly employed in the production of fancies, as this would necessitate the use of either stock-dyed or slub-dyed yarns, a more expensive mode of operation than the ordinary skein dyeing.

One of the principal factors in deciding the type of fabrics to be made at any time is the class of styles which is likely to prove popular. This will be readily understood by those at all conversant with manufacturing, as it is manifestly impossible to attain the desired end if the texture of the fabric is not suitable for the pattern it is desired to produce. It is essential that the styler should have a certain amount of knowledge regarding fabrics if his work is to be of the highest type, though it is not necessary that he should be a designer or

Expert on Fabric Construction.

He must have a sufficient idea of fabrics and styles, however, to decide as to which particular fabric is best adapted to show up any of the styles he wishes to have made. Unless he is possessed of this knowledge, it is necessary for him to rely entirely upon the ability of the designer, who oftentimes is not in sufficiently close touch with the market to be able to form an accurate idea as to what is best suited to the needs of the buyer. The advantage held over his competitors by a styler who has had some technical training is much more apparent in a season when business is limited in volume, for in such a season he is able to develop fabrics which will secure a fair volume of orders, while his business rivals are forced to rely on the judgment of one not in touch with conditions and therefore not in position to construct cloths which will appeal to the buyer.

The Peculiar Advantage

of using the construction here described for the present season lies in the fact that by so doing it is possible to produce a perfect pencil stripe by using a single light-colored thread in the warp and still avoid the stitchy appearance common to most cloths so constructed. The warp is dressed in such a manner that when the light color is lowered, a similar colored pick of filling covers it, forming a continuous line of color without a break. In a similar manner a stripe is formed on the back of the fabric, giving it the appearance of a single cloth, of a relatively higher texture. The advantage of using the three-harness weave instead of the ordinary four-harness even twill will be patent to anyone familiar with cloth construction. It gives a much

Finer Appearing Face

without increasing the number of picks per inch, thereby allowing a greater production per loom than would be possible if the four-harness twill were used with the same number of twills per inch. There are many styles capable of development in this weave and construction, though it is not particularly well adapted for making checks. There is a wide range of styles which might be developed to advantage in this cloth and which should prove to be good dividend producers.

Contrary to the usual experience with three-harness twills, that here described should show a very satisfactory production from the loom, with practically no increase in mending expense over fabrics made in the common twill weave. The yarns used should be made from well-grown wools

of good luster and staple, which have been well scoured with proper detergents and soft water. It may appear to some readers that these are unimportant trifles, but, nevertheless, it is attention to these trifles that ultimately results in perfection. It may seem a detail not worth mentioning to say that the bath used in scouring the wool should never be above 120 degrees Fahrenheit, but should excessive heat be used in this process it will have an effect on the fibre which no amount of after-treatment will rectify. The same statement may truthfully be made relative to the purity of the materials used as detergents on the raw stock or the goods in the finishing room. It is too often the case that processes which

Have an Important Bearing

on finished results are left in charge of unskilled help, who have no idea of the harm that may result from inattention to these apparent trifles, with the result that the finished product is inferior, and no one is able to definitely locate the process that is primarily at fault. In many cases it has been traced back to the very first process through which the stock passed on its way to be manufactured into yarn. The physical structure of the fibre itself may be so injured by improper treatment as to render it incapable of being spun to as fine counts as the grade and length of staple would ordinarily warrant. In the dressing of the warp it will be unnecessary to use size, as the warp yarns are of such size and strength to weave nicely without such treatment. If there are piece-dyed fabrics to be made in the mill it would be perfectly feasible to operate on the two-loom system, giving each weaver one white warp and one fancy. The burlings must be carefully attended to, all knots raised and left for the shear to remove. Should this be done by the burlers, the knots must be well raised and the ends left long enough to prevent their shrinking back in scouring sufficient to make the defect known as pinholes.

Yarns Well Inspected.

The sewers should have but little work on goods of this class if the yarns have been well inspected and all slugs removed before they were put into warps or wound for filling. Goods of this character may be fulled in the grease, as they contain nothing that should injure the appearance of the light colors. The length of time required to obtain the desired amount of nap will vary somewhat with conditions and must, in a large measure, be left to the judgment of the finisher. Fulling should not be carried on long enough to burst the threads, however, as it will materially detract from the appearance of the finished fabric. Probably 30 to 40 minutes in the fulling mill will be found ample for the fabric under discussion. The goods should be immediately transferred to the washer where every particle of dirt and soap should be removed. Inasmuch as worsted goods are comparatively free from impurities, they should not require the use of additional soap, that used in fulling retaining sufficient vitality and detergent properties to thoroughly cleanse the pieces. Do not extract the pieces too thoroughly. This is a precaution that may meet with disapproval in some quarters, but an experience of many years has proven, to the writer's satisfaction at least, that goods too well extracted do not handle as well when finished, as identical cloths which contain slightly more moisture when run into the drying machine. Here, too, we may differ from the practice of some finishers in

Advocating Slow Drying,

with a relatively low temperature. It will be found that goods treated in this manner will have a perceptibly better handle than would be the case were they subjected to greater heat in drying. In fact, the superior quality of goods dried in the open air is not nearly as much due to that fact, of itself, as it is to the slow drying which this method involves.

When dry, the goods should have a few runs on the brush and are then ready for the shear. The shearing of fabrics such as here described con-

sists simply in removing the long fibres and evening up the nap, after which the goods should have another run on the brush before pressing. If the finishing room equipment is complete, it should include a dewing machine, and a run over this should precede pressing. If this is not feasible, a light steaming before entering the press is advised. After pressing and a final inspection the goods are ready for rolling up for shipment.

LAYOUT.

3,024 ends; 11 reed, 4 per dent = 68.7" + 1½" for listing = 70.2" over all.
48 picks.

DRESSED.

2/24 black		2	2
2/24 50% mixture	1		1
			3

FILLING.

2/24 black	1	1	2
2/24 mixture		1	1
			3

CALCULATIONS.

2,016 ends 2/24 black = 4.8 oz. + 10% take-up = 5.33 oz.
1,008 ends 2/24 mixture = 2.4 oz. + 10% take-up = 2.67 oz.

$$\text{32 pks. 2/24 blk.} = \frac{32 \times 70.2}{24 \times 560 \div 2 \div 16} = 5.35 \text{ oz.}$$

$$\text{16 pks. 2/24 mix.} = \frac{16 \times 70.2}{24 \times 560 \div 2 \div 16} = 2.68 \text{ oz.}$$

Loom weight ..... 16.03 oz.

COST.

10.63 oz. black + 10% waste = 11.9 oz. @ 76c. per lb. =	$ .565
5.35 oz. mixture + 5% waste = 5.63 oz. @ 84c. per lb. =	.296
Cost of stock	$ .861
Manufacturing, 48 picks =	.345
Net mill cost	$1.206

MONTAGNAC

This fabric is one of the finest and softest overcoatings produced, either in foreign or domestic cloths. It is in appearance somewhat similar to a fine baby lamb, but has not the same luster nor is the curl quite so decided. It is prized largely because of the unusual softness of the material and the great warmth without excessive weight. That it is not more commonly manufactured is due to the fact that its production requires special machinery in the finishing department and unusual skill on the part of the finisher. For many years practically every piece of this fabric was imported, but more recently domestic mills have been equipped with the necessary machinery, and some very fine goods of this character are now produced by domestic manufacturers.

The appearance of the goods is greatly altered in the process of finishing, and to so great an extent is this true, that anyone not conversant with the methods employed would not think it possible to produce the finished article from the loose, sleazy, uncouth-appearing fabric that comes from the loom. In its unfinished state, or the "flannel," as it is technically termed, the goods are rough and unsightly, with the face threads lying loosely on the surface, but in the hands of a skillful finisher, with the necessary equipment, a truly wonderful transformation takes place, and the uncouth flannel becomes a beautiful cloth, fit for clothing the finest lady in the land. By means of soap, water and heat used in conjunction with the proper machinery, the rough, thready face is entirely hidden under a thick, curly nap that is a delight to both touch and sight.

Manufacturer Receives Small Profit.

The retail price of a fairly good montagnac is from six to seven dollars a yard, which seems a rather high price for a fabric weighing only 26 ounces, composed almost entirely of wool. Without doubt, it does show an

extremely handsome profit, but unfortunately the manufacturer receives a very small part of the retail price as his profit. It is true in the merchandising of woolens, as in nearly all commodities, that the high prices paid by the ultimate consumer have, in a large measure, been added by the middlemen, who handle the goods between the producer and he who finally puts it to the use for which it was originally intended. In the majority of cases it will be found that the producer of the article, be it what it may, receives as his profit an extremely small amount compared with that of the intermediate handlers. How to eliminate the increased cost of merchandise, due to these extra profits, is a question engaging some of our brightest minds at present.

The wools used in the manufacture of montagnacs must be sorted with more than ordinary care, as only the finest, softest stock obtainable can be used for the production of fabrics of this type. After sorting, the stock should be dusted in order to remove as much as possible of the loose dust and foreign matter of various kinds adhering to the fibre, leaving less to be removed in the scouring bath, a material saving of detergents being effected by so doing. For the scouring of the fine wools used, a

Four-Bowl Parallel Rake Machine

is the best possible type, and should be used in conjunction with the very best scouring materials to be obtained, and soft water. This last item is absolutely indispensable, and if a natural supply of soft water is not to be obtained, the supply must be softened by mechanical or chemical means. Wool, in its natural state, as probably every one of our readers is aware, contains a varying quantity of a natural greasy matter, in addition to the various impurities which mechanically adhere to the fleece. This grease or "yolk" must be removed before the wool can be put into the manufacturing process. This is usually accomplished by scouring with some of the familiar detergents, such as soap and alkali. The necessity for soft water in this process is readily explained. The most common cause of hardness in water is the presence of iron or lime salts. When such water is used for wool scouring, the soap is disintegrated and the fatty portions unite with the acids held by the lime or iron compounds, which are also decomposed, forming a lime soap. While ordinary soaps are soluble in water, forming an emulsion, the lime soaps are insoluble and are deposited on the wool in the scouring liquor. In the form of a sticky paste, the lime soap completely envelops the fibre and is

Removed with Extreme Difficulty.

If the fibre is not thoroughly cleansed, however, the dyeing operation is attended with great difficulty, and it will be well-nigh impossible to get level shades. With pure soft water and a well-made potash soap, built up to sufficient strength with a pure mild alkali, a four-bowl washing machine should bring the wool out snowy white. It must be kept in mind that under no circumstances should the temperature of the scouring liquor be allowed to rise over 130 degrees Fahrenheit. Greater heat than this will have a decided tendency to injure the working qualities of the wool.

In these days it is common practice to hasten the drying of the wool by artificial means, but for this type of fabric the aid of steam should not be invoked if possible to avoid it. A much better method is to dry by the so-called "cold air" system, that is by spreading the wool on a suitable screen and forcing air through it at the ordinary temperature. Wool dried in this manner will be found to work much better in subsequent operations. If the goods are to be stock-dyed, the next operation is the dyeing. For especially fine goods it is the usual custom to color the blacks with an indigo bottom which gives them a body and bloom that cannot be obtained by any other method. After drying from the dyehouse, the stock is ready for the mixing picker. That the fibres may be more easily carded and spun

it is necessary that a lubricant of some kind be applied in the picker room. This is usually applied in the

Form of an Emulsion,

made by mixing some suitable oil with a certain proportion of water and "cutting" the oil by the addition of a small quantity of alkali such as borax, sal soda or soda ash. In working fine wools, a very satisfactory emulsion may be made by using equal parts of a good, repressed red oil and water, emulsified with sal soda. This should be used in the proportion of eight quarts of emulsion to 100 pounds of stock, an equivalent of four quarts of oil per hundredweight of wool. There are various methods in use for applying the oil, most of which are satisfactory if used intelligently, the prime object of them all being to distribute the oil as evenly as possible over the entire mass of wool. Some of the mechanical devices for attachment to the picker are productive of very good results, and probably secure a more even application than is usually obtained by the old system of using a specially prepared sprinkler similar in form to the ordinary watering can. The stock should be put through the picker twice to be sure that it is well opened and mixed, then it may be conveyed to a suitable bin convenient to the feed box of the first breaker card.

The cards must be in A1 condition, the wire sharp and set sufficiently close to thoroughly comb out the stock without injuring the staple. The wire should be fairly fine, not coarser than 30 on the first and second breaker, with 32 on the finisher. With fine stock, such as used in the fabric under discussion, it will be possible to take off a rather heavy roving, which will give a relatively larger production from the card room and still give excellent results in the mule room, and make a strong, even elastic thread. In spooling, there is a distinct advantage in using the

Compressing Type of Spooler,

as much more yarn can be placed on each spool with a correspondingly increased production in the dressing room, for there will be less stoppage for tying in spools. The paddle weights should be so adjusted on the dressing frame that every section will receive the same tension, thus eliminating the danger of imperfections known as "section stripes" in the finished goods. The warps should be made as long as the pins on the reel will permit, and in beaming, a warp compressor should be used. This device permits of putting a much greater yardage on the beam with no undue strain on the yarn, makes a warp that is solid and even and adds to the ease of weaving to a very appreciable extent. When the warps are drawn in, reeded and ready for the loom, the fixer should see that the loom is in the best possible condition, go over the various parts and see that they are so adjusted as to give the best possible results on the class of work to be woven. It is much better to give the loom the necessary attention when empty than to delay the weaver and possibly make some cloth that is imperfect while the warp is starting up.

The burling and sewing is a very small item on this class of fabrics, as there is no danger of cutting knot holes on the shear from the fact that the goods are merely cropped. The question as to the

Best Time for Fulling Montagnacs

is one each finisher decides for himself, some preferring to scour in the grease, while others insist that better results are obtained by first scouring the goods. In either case the use of pure soaps and alkali must be insisted on, as harsh alkalis will cause absolute failure to secure the desired finish. For fulling, a pure neutral palm oil soap is preferable to one made from a tallow base. It is customary with some finishers to interrupt the fulling process and give these cloths some work on the napping machine before the fulling is completed. From the mills, the pieces should be transferred immediately to the washers and given a run for 20 minutes with warm water, after which

they should be well rinsed. Every vestige of soap must be removed before they are taken from the washer, or it will be impossible to get a satisfactory finish. When satisfied that the goods are clean, extract and place on the napper. When, in the judgment of the finisher, they are sufficiently napped, place on the cropping shear and even up the fibres, nap again, crop and dry.

The Dried Pieces

are given several runs on a brush with stiff bristles so as to raise the nap thoroughly, then taken to the whipping machine which causes the nap to stand straight up. From the whipper they are led to the curling dryer, passing before a perforated pipe which thoroughly wets the pile without perceptibly dampening the fabric itself. It immediately passes into the drying chamber, where the heat causes the nap to curl back on the cloth. On looking into the dryer the surface of the cloth appears to be covered with a mass of wriggling worms, caused by the heat acting on the moist nap. The drier must be of sufficient length to permit of thoroughly drying the goods without reversing the fabric, that is to say, it must not be necessary for the face of the goods to pass over a roll or the finish will be spoiled. When dry, the goods require no shearing or pressing, but are ready for inspection and rolling up for market.

LAYOUT.

2,016 ends; reed 7—4 = 72" + 2" for listing = 74" over all.

50 picks—1 face.
1 back.

CALCULATIONS.

2,016 ends 1¾ run = 11.52 oz. + 3% ..... = 11.85 oz.

25 picks 1¾ run = $\frac{74 \times 25}{175}$ ..... = 10.57 oz.

25 picks = $\frac{74 \times 25}{275}$ ..... = 6.72 oz.

Loom weight ..... 29.14 oz.

COST.

11.85 oz. + 15% shrinkage = 13.94 oz. @ 52c. per lb..... =	$ .455
10.57 oz. + 15% shrinkage = 12.43 oz. @ $1.75 per lb..... =	1.367
6.72 oz. + 15% shrinkage = 7.91 oz. @ 40c. per lb..... =	.198
Stock cost	$2.020
Manufacturing, 50 picks ..... =	.600
Net mill cost	$2.620

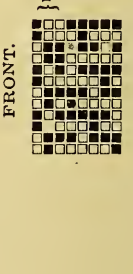
Warp: Fine wool @ 52c.

FACE FILLING MIXTURE.

50% fine Australian @ $1.02..... =	$ .51
50% cashmere @ $2.50 ..... =	1.25
	$1.76

BACK FILLING MIXTURE.

60% fine wool @ 52c..... =	$ .312
40% fine extract @ 22c..... =	.088
	$ .400



SILK STRIPE POPLIN

Poplins are made in a variety of constructions and weights, from silk, worsted and combinations of either with cotton. The fabric selected for analysis is made from worsted, both warp and filling, with a decorative stripe of silk twist at intervals of approximately three-quarters of an inch. The present season has seen a greater revival of popularity for this extremely serviceable cloth than has been apparent for some time. In appearance it very much resembles the piqués so much used for skirting purposes during the summer season. Its production is confined to a great extent to the large corporations who make a specialty of dress goods and have had the necessary experience to enable them to produce such cloths at a price

that would mean ruin for the ordinary mill. By making fabrics of this character in quantities,

Spinning Their Own Yarns,

and the careful elimination of every expense item which may possibly be cut out, they are able to manufacture for much less than a mill not specially equipped for turning out fabrics of this kind. The yarns used are, in nearly every instance, made from the foreign crossbreds, though limited quantities of domestic wools are also used by some of the large producers of domestic dress goods. That intrinsic worth is not at all times the basis on which prices are figured is well exemplified by two samples of poplin shown the present season by a large department store. One of them is a 40-inch fabric, about 7½ ounces in weight, selling at $1.25 per yard, while the other is a 12-ounce cloth with worsted warp, and a coarse cotton filling which comprises about two-thirds of the total weight and sells for $2.50 per yard. That the greater portion of buyers are practically ignorant of the composition of the fabrics offered is incontrovertible, but that such ignorance is so prevalent among buyers for the various departments in our large mercantile establishments is inexcusable in these days, when a knowledge of fibres and cloth composition is so much more readily obtained than has been the case in the past.

Expert Technical Training Not Necessary.

It is not at all necessary that the salesmen should be technically trained experts, but it would not appear unreasonable to expect that they should be able to detect the difference between a fabric that is pure wool and one that contains a considerable quantity of cotton that is not amalgamated with wool during the process of manufacturing. In the all-worsted fabric here analyzed, the warp and filling are both single yarns combed from wool of medium grade and fairly good staple spun on the French system. The warps are dry dressed and then sized on the slasher, which insures an equal distribution of the sizing material, as well as giving a nice straight warp, which usually weaves better than would be the case if the warps were sized on the dresser. The weaving is invariably on the two-loom system and the fabrics piece-dyed. The introduction of the silk decoration will in no wise interfere with this method of manufacture, as there is a variety of dyestuffs on the market which will produce the desired shade on the wool without

Changing the Shade of the Silk.

In order to obtain the rib effect peculiar to this fabric the goods are frequently woven two picks in a shade, but the same effect may be produced by the use of a filling yarn of sufficient size to obtain the desired result with one pick. If this method is used it will effect a very material increase in the production per loom and also result in a very appreciable saving in the cost of the yarn, as it is evident to the layman that one large thread may be manufactured at a much less cost than two threads of approximately half the weight. The finishing of poplins does not present any unusual or peculiar features. The goods are burled and mended, then placed in the washer and cleansed with any good soap. The precise grade is a matter to be decided by the finisher and manager of the plant. In some of our larger mills it is the custom to manufacture their own soap.

The saving in expense thus effected is possibly not so much a feature as the fact that the soap so made is at all times of the same grade and of absolute purity, which is not true in all instances when soaps are purchased in the open market. The

Necessary Facilities for Soap Making

are not expensive, nor is the manufacturing a particularly difficult operation. A very satisfactory soap may be made from the formula here given, and may be used for scouring the raw stock or woven fabrics. Dissolve 200

pounds of caustic potash in 50 gallons of water, boiling until thoroughly dissolved and add water to make 200 gallons, making a solution of a pound of alkali to the gallon. At a temperature of 65 degrees Fahrenheit the dye should test close to 140 degrees Twaddell. Run the lye into barrels with a gallon of red oil to each four gallons of the liquor, agitating occasionally until the ingredients are thoroughly mixed, forming a soft soap. This may be used as the base for a scouring liquor for raw stock or may be boiled up with the addition of alkali and water for scouring piece goods. When the goods are free from impurities and the soap has been thoroughly rinsed out, they should be transferred to the

Continuous Crabbing Machine,

which will give them a "set" and put them in excellent condition for the dyehouse. Better results will be obtained if the pieces are allowed to remain on the rolls for at least 24 hours before sending them to the dye kettles. The rolls should be stood on end and the position reversed at intervals of six to eight hours to prevent the moisture settling at either side of the piece, as this would be apt to cause trouble in dyeing. The great difficulty encountered in piece-dyeing is shady goods, either shaded from side to center or end to end. In the major part of such instances the trouble may be traced to improper treatment in scouring or crabbing rather than in the dyeing department itself. When the desired shade has been obtained, cool off with cold water, running into the kettle with the draw-off plug released and give a thorough rinsing berore removing from the kettle. Five minutes in the extractor should be ample to prepare the pieces for the drying machine. In drying, the heat should not be excessive, for the handle of the goods will be materially improved if the dryer be enlarged rather than to force the operation in a small machine by increasing the temperature. After drying, the pieces should have a run on the brush before shearing and another brushing between the shear and the dewing machine. The pressing should not be too heavy, and after a final inspection the goods may be measured and packaged for market.

LAYOUT.

3,600 ends; reed 12—6 = 50" + 1½" for listing = 51.5" over all.
80 picks.

DRESSING.

1/32 white	36	30	66
1/32 white and white single org. silk	6		6
			72
			5
			360
			*10
			3,600

*Sections.

CALCULATIONS.

3,600 ends 1/32 = 3.21 oz. + 10% take-up .....= 3.5310 oz.
300 ends single org. = .3202 oz. + 10% take-up .....= .3522 oz.

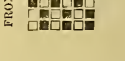
$$80 \text{ picks } 1/24 = \frac{51.5 \times 80}{560 \times 24 \div 16} \quad ...= 4.9040 \text{ oz.}$$

Loom weight ..... 8.7872 oz.

COST.

3.531 oz. + 5% waste = 3.72 oz. @ 84c. per lb. .....=	$ .196
.3522 oz. + 5% waste = .3707 oz. @ $8.50 per lb. .....=	.199
4.904 oz. + 3% waste = 5.06 oz. @ 80c. per lb. .....=	.253
Cost of stock	$ .649
Manufacturing, 80 picks .....=	.400
Net mill cost	$1.049

Six harness, straight draw.



UNFINISHED FANCY WORSTED WITH SILK DECORATION

A particularly attractive style in heavy-weight men's wear is the double and twist worsted suiting with silk decoration, the analysis of which is here given. By means of well-chosen colors for the twists, it is possible

to develop a very attractive line of styles that should meet with a ready sale. The fabric itself presents nothing particularly new in the way of construction or finish and owes its desirability in a large measure to the nicely blended colorings of the twists used in the warp together with the additional life and character given by a judicious use of spun silk twisted with a black worsted. The whole effect is very pleasing and gives the appearance of a pin check picked out with silk. The texture of the fabric is relatively low, counting only 52 ends and 48 picks per inch, which should show a very satisfactory production, as the looms, 82 inches in width being preferable, may be operated at a speed of 120 picks per minute. With good yarns and well prepared warps there should be no trouble encountered in the weave room with looms of the proper type at this speed. In these days of hard competition it is essential that production shall be large, as the possible margin of profit is very low, indeed, on goods which are not in the novelty class.

In order to earn a dividend that shall be satisfactory to the stockholders it is necessary that everyone in the manufacturing department devote their energies to securing the largest possible output of perfect goods. In some mills the latter item seems to be lost sight of to a marked extent, with a resultant high rate of finishing expense, and too often an

Excess of Remnants

and seconds. In the production of the type of goods under discussion there should be an extremely low percentage of seconds made, and should the "strings" or allowances for imperfections average over two for each piece, it would be wise to undertake a rigid investigation as to the cause and see that further work of that sort is eliminated.

If the yarns are spun by the mill weaving the goods there is absolutely no excuse for poor work, and if they are purchased in the open market, no reputable spinner would continue to deliver yarns not up to the standard if the matter were called to his attention. Yarns for the production of such fabrics as this should be spun from well selected fleece wools, with no admixture of pulled wools, as those are termed which are taken from the skins of dead animals. The yarn made from wool shorn from a living sheep is much brighter, loftier and of greater strength than any that can be made from the same grade of pulled wools. For the manufacture of the worsted twists, top-dyed yarns should be used, as in this method of manufacture the noils are left in the white, in which condition they are more salable and command a much higher price. Top-dyeing may be performed in a variety of ways, one of the most common, in use in many mills fitted with skein-dyeing machines of the Klauder-Weldon type, being to make skeins of the top and dye in the same manner as yarn. This is hardly as satisfactory as the

Method of Dyeing in Balls,

as now in common use by a large number of job dyers and worsted spinners. By this method it is unnecessary to handle the top so often, and, on the whole, better results are obtained. The balls of top are placed on a perforated spindle in a suitable receptacle and the dye-liquor forced through by means of a pump. In this way perfect penetration is obtained and a level color assured with no damage to the material. When the desired shade is obtained the liquor is pumped into a tank or allowed to flow into the waste way, the tops removed from the dyeing machine, extracted, dried, and are then ready for the gilling process. In the sample here analyzed, three distinct twists are used: A dark ox-blood red is twisted with olive, a sapphire with black, and a white silk with black for the warp colors, while the filling is all black. The warps may be dressed on a dry frame, as the size and strength is such that sizing is not needed to insure good weaving. In the weave room, the looms should be carefully adjusted when the warps are

started and should require comparatively little attention from the fixer until the warp is out, as the weave is easy and will not cause undue strain on any part of the mechanism. For goods of this description a loom with positive take-up is much the best type to use, as it practically

Eliminates All Trouble

in the way of uneven cloth, and in a measure insures that the correct texture is maintained throughout the piece. After weaving, the goods should be measured and inspected, all imperfections marked with a chalk that may be readily removed in the scouring, and the details as to length, weight, piece number, etc., entered on suitable sheets provided for that purpose. In the burling room the knots should be raised, slugs removed, and all imperfections not indicated by the percher should be marked at this time, so that the sewers may not waste valuable time in looking for damages requiring their attention. The goods are now ready for the fulling, and should be run into the mill double, or two pieces at once. The soap used should be a pure neutral palm oil built up to the required strength with a mild alkali. The use of a soaping machine, to secure even distribution of the soap, will materially assist in attaining satisfactory results. When sufficiently fulled, the pieces should be immediately transferred to the washer and given a run with warm water for 20 to 30 minutes, which should be sufficient to float out the grease and dirt, then rinsed in warm water and worked for half an hour with clear cold water. Extract for three minutes, wet brush and dry. From the dryer the pieces should go to the back burlers and then have two or three runs on the brush before shearing.

The shearing of this type of fabric is a short operation, as all that is required is the evening of the nap and clipping off all the long, loose fibres. From the shear the pieces should go to the fine sewers, where imperfections hitherto unnoticed may be repaired, when the goods are ready for the final brushing. Before pressing give a run on the dewing machine, then give a fairly heavy press, roll up hot and allow to cool off on the rolls. The finish will be much improved if the goods are not disturbed for at least 24 hours.

LAYOUT.

2,912 ends; 10¾ reed, 4 in dent = 67.7" + 1½" for listing = 69.2" over all.
48 picks.

DRESSING.

2/22 black and 60/2 white silk tw.	1		1
2/22 black and sapphire tw..		1	1
2/22 ox blood and olive tw...		2	2
			4
			104
			416
			*7
*Sections			2,912

Filling: 2/22 black

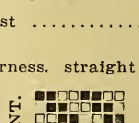
CALCULATIONS.

2,184 ends 2/22 tw. = 5.67 oz. + 10% take-up =	6.300 oz.
728 ends 2/22 black = 1.89 oz. + 10% take-up =	2.100 oz.
728 ends 60/2 silk = .231 oz. + 20% take-up =	.288 oz.
48 pks. 2/22 blk. = $\frac{48 \times 69.2}{24 \times 560 \div 16 \div 2}$ =	8.690 oz.
Loom weight	17.378 oz.

COST.

6.3 oz. + 5% waste = 6.63 oz. @ 84c. per lb. =	$ .348
2.1 oz. + 7% waste = 2.26 oz. @ 72c. per lb. =	.102
.288 oz. + 3% waste = .297 oz. @ $3.36 per lb. =	.062
8.69 oz. + 5% waste = 9.14 oz. @ 72c. per lb. =	.411
Cost of stock	$ .923
Manufacturing, 48 picks	.350
Net mill cost	$1.273

Eight harness, straight draw.



CREPE CLOTH

One of the most popular fabrics shown in the dress goods trade this season is the crepe in a variety of weights and colors. Possibly it owes part of its popularity to the fact that it ministers to the craving for something new, which is ever present, particularly with the feminine portion of our population. The novel feature of the cloth is its light weight and full handle, combined with the facility for draping very nicely. In the cheaper grades it is shown made up into popular-priced suits, to sell at retail for $17.50 to $20, according to the location and clientele of the merchant. The novelty effect produced is entirely the result of the weave used, and does not depend on unusual shrinkage of the yarns, as do many of the fabrics sold under this name. The stock used for the manufacture of the sample here described is combed from one of the foreign crossbreds, New Zealand or South American, or possibly a blend of both of them. Both these wools are

Particularly Well Adapted

for use in dress goods manufacture, and the greater part of the importations of these stocks are used in the production of fabrics for women's wear. In view of the great number of automatic looms now operating so successfully on many types of cotton goods, it would seem that they might find an extended field in the production of many of the worsted dress goods that are woven in the grey and afterward piece-dyed. A few of them are in successful use and should create hard competition for mills not so equipped. Fabrics of this character, in which the warps are made from strong, two-ply yarns, should show a considerable saving when made on automatic looms over those woven on the ordinary type of loom. The yarns in the sample analyzed are of comparatively low grade, the warp a two-ply and the filling a single thread. The production of this fabric in quantity may safely be undertaken by any mill having fancy looms of 12-harness capacity, as

A Variety of Styles May Be Made

that require a no greater number of harnesses. The warps may be dressed on a dry frame, then placed in the slasher for sizing, which will effect a considerable saving in time over the wet dressing frame, and usually is productive of much better results in the weave room. Before putting the warp into the loom, the fixer should take the time required to go over the

LAYOUT.

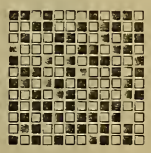
1,900 ends; 9½ reed, 4 in dent = 50" + 1½" for listing = 51½" over all.
50 picks.

CALCULATIONS.

1,900 ends 2/30 = 3.62 oz. + 10% take-up ..... =	3.982 oz.
50 picks 1/20 = $\frac{575 \times 50}{20 \times 560 \div 16}$ .... =	3.534 oz.
Loom weight	7.516 oz.

COST.

3.982 oz. + 5% waste = 4.19 oz. @ 70c. per lb. ..... =	$ .18331
3.534 oz. + 3% waste = 3.644 oz. @ 64c. per lb. ..... =	.14576
Cost of stock	$ .32907
Manufacturing, 50 picks ..... =	.25000
Net mill cost	$ .57907



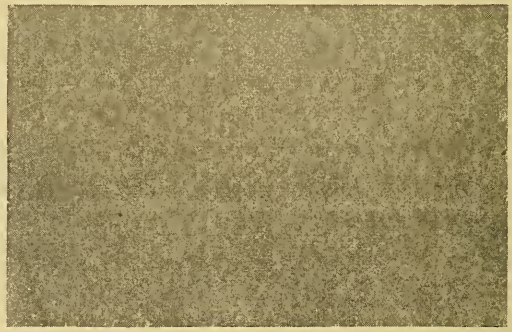
loom thoroughly, and see that it is in the best possible condition, as many parts may now be reached with ease that are not easily gotten at when a warp is ready for weaving. The finishing is not essentially different from the process usually pursued with clear finished fabrics and requires the use

of no special machinery. After burling and sewing, the pieces are scoured in the ordinary type of washing machine and then immediately transferred to the crab.

While many finishers are of the opinion that the old style Yorkshire is productive of the best results, there is a rapidly growing number who are in favor of using the continuous crab for this class of fabrics. The fact that it requires less labor and is a much more rapid process has done much to assist it in acquiring the strong position it now holds with finishers who are familiar with its use. The goods should be allowed to remain on the crab rolls until they are thoroughly set and may then be taken to the dye-house. The dyeing is performed in the ordinary type of kettle with a reel over which the goods pass. The form of reel approved by many dyers is a wooden drum, on which rounded knoblike blocks are placed at intervals, which prevent the cloth from running continuously in the same folds. When dyed, the goods are cooled off and well rinsed before removing from the kettle, then extracted and dried. After a run on the brush they are sheared, again brushed, pressed, inspected and rolled up for market.

FIGURED DRESS GOODS

Among the novelties offered the present season, one of the most popular of the worsted fabrics is the brocade effect, either produced by means of the weave alone, or with the addition of extra threads for the figure in warp or filling, or, in many cases, in both systems of threads. The threads used for the formation of the figures are sometimes identical with those of the groundwork, and in other instances are of a different size or of an entirely different material. It is not at all unusual to find a groundwork of cotton with figures of worsted, or a worsted ground with silk figures. The type of fabric illustrated and analyzed is composed of worsted warp and



Figured Dress Goods.

filling, with the decorative threads of a relatively large size when compared with the ground.

One of the chief features in which this fabric differs from many of those which have sold so freely in the recent past is in the method of producing the figure. The yarns used for the figure effect are first skein-dyed to a dark shade and then dressed into a warp of grey yarn. By means of piece-dyeing, it is possible to produce a number of very effective styles

from one dressing. The dark threads which form the figure on the face of the goods are not changed in color, or to a very slight extent, while the yarns in the grey, which form the groundwork, may be dyed to practically any desired shade. There are several decided advantages in this method of manufacturing, and it may be applied to many other cloths with equally good results. By this procedure the coloring of the ground warp in the skein is eliminated, with a considerable saving of steam and labor, as well as the winding from the skein to six-inch double headed spools, and the transfer from these to the dresser spools, with its attendant expense and waste of material. An equal saving is made on the single yarns used for the filling. If the goods were to be woven in the colors of the finished fabric, it would necessitate either dyeing the stock for the filling in the raw state, or in the form of slubbing or top. The first and second methods are not in common use at the present time, as either of these systems would produce colored wastes and noils, which are not salable at prices which can be obtained for these by-products in the grey.

If necessary to produce a single yarn, in colors, the method most in vogue in modern mills is to dye the top, which eliminates the making of the major portion of the colored wastes. There are a number of machines on the market which are built especially for work of this kind. One of the most satisfactory, perhaps, is that in which the balls of top are packed in a can around a central perforated spindle, through which the hot dye-bath is driven by means of a force pump. By this method the tops are colored

Without Injury to the Sliver,

and penetration is absolute with extremely level shades. After coloring, the tops are put through the back-washer and are then ready for the drawing process. It will be readily understood, even by the novice, that; dispensing with these operations, which may be done by the method of cross-dyeing used in the production of these fabrics, will mean a considerable saving in the cost of manufacture, and give results that are extremely satisfactory. The yarns used, both for the ground and figure of this cloth, are spun from quarter-blood wools, and may be either foreign or domestic crossbreds. The greater part of the dress goods manufactured from this grade of stock is made from the South American and New Zealand crossbreds, as these wools are particularly well adapted for the production of fabrics of this type, and are not very desirable for making yarns for men's wear purposes.

The manufacture of domestic worsted dress goods is very extensively confined to the larger corporations who are equipped with machinery to produce their own yarns from the raw stock. This enables them to eliminate part of the expense incident to buying the yarns from outside spinners, and also enables them to have yarns of a uniform grade at all times, which would not be possible if they depended on worsted spinners for their requirements. Probably the strongest argument in favor of operating their own spinning plant is the fact that by so doing they are enabled to

Cut Out the Spinner's Profit

and reduce their manufacturing costs by eliminating part of the expense incident to the operation of two independent organizations. While it is manifestly impossible to manufacture the yarns at a labor cost much less than that of the independent spinner, it is possible to reduce the overhead charges to an appreciable degree, and add part of his legitimate profits to the margin of profit on the goods. In order that the manufacturer may earn good dividends for his mill, it is essential that his production should be well sold every season, and this result can only be realized by having his

prices on a parity with other makers of similar lines, and in seasons of hard competition the

Margin Between Cost

and selling price becomes microscopic. It is in seasons like this that the ability of the management has its severest test. Every season there are many fabrics shown which, from the sellers' standpoint, are about equally desirable, but because of some particular feature connected with one of them, it is much more difficult to obtain a satisfactory production. In this case it is the manager who is thoroughly informed as to his organization and its capabilities who wins out. By a wise selection of fabrics he is enabled to run his plant on the styles that will show the largest net returns.

Frequently a slight change in the size of yarns or construction will change a fabric from an unprofitable cloth to one that will show a good margin of profit. Then, too, it is possible to so change a style that the general effect and selling capacity will not be depreciated in the least, while its rate of production will be very materially increased, with a consequent lowering of the manufacturing cost. In the cloth under discussion the texture is relatively low, but the weave used for the background gives it an appearance of comparative fineness, which it would be impossible to obtain were a different weave used. The warp counts but 48 threads to the inch, and is dressed with six ground threads and two figure threads to the pattern. The filling has but 44 threads to the inch, six of ground and two for the figure, as in the warp. The figure is developed by floating the comparatively coarse ends in warp and filling over a portion of the ground in some places and at others by interlacing them with the ground threads. A great variety of styles may be made by the skilled designer even with the small number of threads used in this pattern, and by increasing the number of ends to the pattern and the harnesses the number of combinations possible with the

Ordinary Harness Loom

goes into the hundreds. If the jacquard head is called into play, the patterns become almost infinite in variety. To obtain the best results, the manufacture of the yarns is an extremely important feature, as this determines in a large measure the production of the looms. The yarns should be made from long-staple, well-grown wools, well sorted and scoured. In the drawing room there is a tendency to overdraft the sliver in order to lessen the number of operations, but such methods are not conducive to the best results and are to be avoided.

Very common defects in worsted yarns are slugs or bunches on the yarn which require considerable time and labor to remove in the finishing room. Many of these are carried in the spinning room by the use of defective top rolls, those on which the leather covering has become worn in places, allowing the roving to pass through in lumps instead of being properly drawn out. That imperfections of this sort may be reduced to a minimum, the frames should be inspected at frequent intervals and defective rolls replaced by others in perfect condition. This is even more essential when making the single yarn used for filling, as there is

No Opportunity for Inspecting

this and removing the imperfections before they are woven into the goods. The warps may be dressed on a dry frame and drawn in without slashing, as the use of two-ply yarns will obviate the necessity for this operation. After weaving, the goods are examined for imperfections and measured in the weave room, then taken to the burlers, where the knots are removed, slugs reduced and bits of foreign matter picked out. The menders will replace all broken threads, repair damages caused by floats and imperfec-

tions of other kinds. Next in order is the scouring operation, which is very important, as improper treatment in this process will be the cause of serious trouble in the dyehouse. The goods should be scoured with a pure, neutral soap, built up to sufficient strength with a pure, mild alkali. It should not be necessary, in the case of worsted goods, to use any harsh

LAYOUT.

2,592 ends; 10 reed, 4 in dent = 64.8" + 1½" for listing = 66.3" over all.
44 picks.

DRESSED.

Black	2	2	2
White	6		6
			8

FILLING.

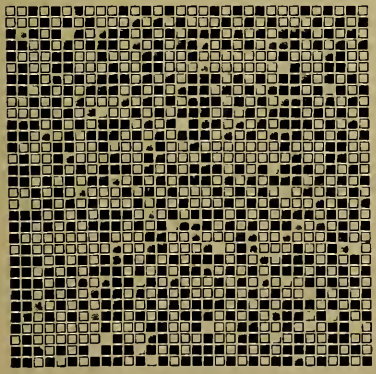
Black	2	2	2
White	4		6
			8

CALCULATIONS.

648 ends 2/22 = 1.711 oz. + 5% take-up =	1.796 oz.
1,944 ends 2/32 = 3.47 oz. + 5% take-up =	3.548 oz.
11 picks 2/22 = $\frac{11 \times 66.3}{22 \times 560 \div 2 \div 16}$ =	1.893 oz.
33 picks 1/24 = $\frac{33 \times 66.3}{24 \times 560 \div 2 \div 16}$ =	2.604 oz.
Loom weight	9.841 oz.

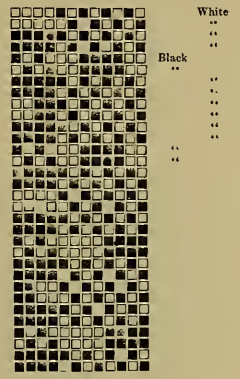
COST.

3.689 oz. 2/22 ¼ black + 5% waste = 3.88 oz. @ 78c. per lb. =	$ .1891
3.548 oz. 2/32 ¼ white + 5% waste = 3.73 oz. @ 70c. per lb. =	.1631
2.604 oz. 1/24 ¼ white + 3% waste = 2.68 oz. @ 64c. per lb. =	.1072
Cost of stock	$ .4594
Manufacturing, 44 picks. =	.2500
Net mill cost	$ .7094



FULL WEAVE.

WEAVE.



DRAFT.

detergents, as the pieces contain but little in the way of impurities. It is very essential, however, that the pieces should be thoroughly cleansed and the soap entirely rinsed out. It will not be necessary to dry the goods, but give them five minutes in the extractor, and take them immediately to the

continuous crabbing machine, which will put them in perfect condition for the dyeing.

Cross-dyeing is not essentially different from the ordinary system of piece-dyeing, and is carried on in the regular piece-dye kettles. The chief feature to be considered is the use of dyes which will

Not Affect the Color

of the yarns previously dyed in the skein, which are introduced for decorative purposes, or, in the case of cotton or silk decorations, the use of drugs which have no effect on these fibres. In recent years there have been brought out a great variety of dyestuffs particularly adapted for this class of work, and which give practically perfect results if used with due care. The pieces are cooled off and rinsed in the tub, extracted and dried, then taken to the brush and given a run or two before shearing. The shear must not be set close, as it is not required to give the fabric an extremely clear finish; in fact, this would be impracticable, as close shearing would result in clipping off part of the comparatively loosely woven figure threads. When sheared, a run on the dewing machine will prepare the pieces for pressing, after which they may be inspected and rolled up for market.

CERISE CLOTH

A very attractive novelty, which may be easily manufactured on looms capable of carrying a small number of harnesses and but two shuttles, is the "peau de cerise" here illustrated. The warp is dressed entirely of one color with two colors used in the filling, one of them the same shade as the warp, while the other is of a contrasting color forming a stripe on the face of the fabric. This method may be employed to make a great variety of stripes in various widths and in combinations of two, three or four colors. The principle on which this type of stripe is made is the use of a warp and ground filling with the addition of an

Extra Filling to Form the Stripe.

The fabric illustrated has a white warp drawn on four harnesses, with one pick of white and one pick of black in the filling. It is capable of development in all wool, cotton and wool, or may be made, as is our sample, from worsted and wool. It is absolutely essential that the filling forming the stripe be composed of wool, or it will not be possible to obtain the desired effect.

The peculiar feature of the fabric illustrated is that the stripe is clean cut on both face and back, the only apparent difference being in the finish. The warp is made from a half-blood wool, spun on the French system, with the worsted filling from the same stock. The black wool used to produce the colored stripe is spun from a nice.

Twelve Months' Texas Wool,

which is particularly well adapted to this type of fabric. The wool is fine, and has rather more serrations than many other types, giving it peculiar felting properties, which are features that especially fit it for producing the desired finish.

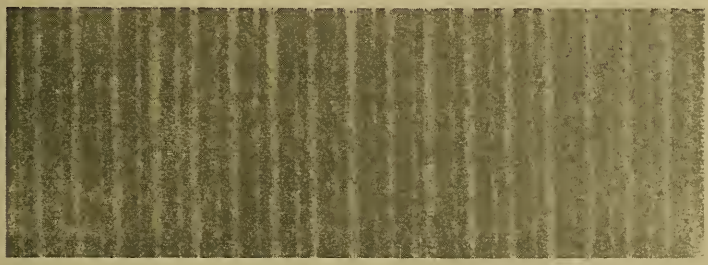
To obtain the best results and make all the profit possible, the manufacturer should have not only the equipment for weaving, but also worsted and wool yarn making machinery. Unless all the yarns required are made by the weaver, the margin of profit will be extremely small. The worsted yarns may be purchased in the open market by a weaver who has machinery for making the wool filling, but such a course is not to be recommended, as the use of single worsted warps by those not accustomed to weaving

them is usually attended with considerable difficulty and results in the making of a large percentage of seconds, or goods that require an excessive number of allowances. Concerns that engage extensively in the manufacture of fabrics which require the use of single worsted for warp purposes are usually equipped with machinery particularly adapted for that kind of work.

Instead of using a wet dressing frame, which of necessity must be operated at a relatively slow speed, the

Warps Are Dressed on a Dry Frame

and sized on a machine known as a slasher. By so doing, a considerable amount of time is saved, for instead of operating at a slow speed, as would be necessary to dry each section individually on the dresser, the entire width of the warp is sized and dried in one operation. The slasher is a machine slightly wider than the warp is laid out in the loom. It consists in the main of a size box with rolls between which the warp passes, and



Cerise Cloth.

which remove the excess size by pressure. From the squeeze rolls the moist threads are conveyed by means of small tin rolls between steam coils that thoroughly dry them before they pass out of the machine and are wound on the loom beam. Between the slasher and loom beam, it is customary to place a reed, through which the threads are drawn, and in this way they are kept in their correct position. This method of making the warp produces a much

Better Weaving Warp

than one beamed directly from the dressing frame. The type of slasher described above is one of the most commonly used, though in some mills is found a machine more nearly approaching the type commonly found in cotton mills. The purpose of the machine is the same, but the drying is accomplished in a slightly different manner. In the latter type of slasher the threads pass around in contact with the major part of the circumference of a large steam-heated cylinder which thoroughly dries the yarn. The looms used are usually a light model of the Knowles type operated at a rate of speed somewhat less than is customary in mills making fabrics of all two-ply yarns.

The wool filling, which gives the characteristic finish of the cloth, must be made from a fine wool with good filling qualities, and the twelve months' Texas possesses this to a remarkable degree, and is also of sufficient length to make a thread that will be strong and produce excellent work in every department of the mill. The stock must be carefully sorted and

well scoured. In many instances where trouble has been encountered in later processes, the source of the difficulty has been

Traced to the Scouring Department.

There are several things connected with this department that may cause untold difficulty in subsequent operations. There are many mill managers who seem to hold the opinion that wool scouring is such an extremely simple process that it requires no particular skill or intelligence on the part of the operative. In reality, it is one of the most important processes through which the stock passes in its manipulation into the finished fabric. During the scouring, through lack of care on the part of the man in charge, the fibre may become so injured that it will be totally unfitted for the purpose for which it was intended, or it may be found impossible to spin it to the counts desired. This may seem incredible to those not familiar with the physical structure of the wool fibre, but many manufacturers have learned it to be a fact in the school of experience. The

Use of Impure Detergents,

an excess of alkali in the scouring bath, maintaining too high a temperature during the scouring, or the use of hard water, each of these will have a very deleterious effect on the stock, if, indeed, it is not absolutely ruined. Harsh treatment in the dry room, too, will materially affect the working properties of the wool, cause it to become harsh and brittle, liable to break easily in the carding and to lose the kindly feel so much desired in the finished goods. If possible, the wool should be dried without the aid of artificial heat, or by the so-called cold air process. Fabrics made from wool so dried will finish up with a much better touch than is possible to obtain with wool which is dried too rapidly by means of a high temperature. Next in order is the dyeing, and for the fabric analyzed there is nothing better in the realm of dyestuffs than the old reliable

Logwood or Hematine Black.

The stock is prepared with a chrome mordant and afterward colored with hematine. There is no disputing the fact that this method is slow and laborious, but where is the one dip black that has the beauty and bloom of the shade obtained in this manner? When thoroughly dry the stock is ready for the picker. In order that the stock may be easily carded, it is necessary that a lubricant of some kind be applied, as the natural oil contained in the wool in its original condition has been removed by scouring. As to the best oil to use, or perhaps it would be better to say, the most satisfactory oil, from the viewpoint of efficiency and economy, there is a considerable diversity of opinion, and it is not within the scope of this article to exploit any particular brand. In order to apply the oil as evenly as possible, it is customary to mix it with water and emulsify by the addition of a small quantity of some mild alkali. This emulsion is applied while warm and beaten into the wool with a long stick to secure penetration of the entire mass. Sufficient emulsion should be applied to give the proportion of four quarts of oil per hundred pounds of wool, which on stock of this character will be found to give excellent results. After oiling and mixing, the stock should be kept in a cool room, not too dry, in order to prevent undue evaporation. Carding and spinning should not present any difficulty with clear stock of this grade, well prepared in the picker house. The preparation of the warps will require considerable care, as under the best of conditions single warps are apt to weave as well as those made from two-ply yarns. To insure good work in the looms, the warps must be well sized with a material that will hold all the loose fibres to the thread so as to prevent chafing during the weaving operation. With poor sizing materials it will be found extremely difficult to secure a good production in the weave room or goods that may be finished without excessive expense in the mending department.

Goods of this character may be woven on the double loom system very readily, as the fineness of the filling will require the changing of the shuttles with comparative infrequency, thus allowing the operative plenty of time to see that perfect work is being made. Burling and sewing should be thoroughly done, with an inspection by the percher to see that the girls are not slighting these important items. The wet finishing is a

Very Important Process

in the production of any kind of goods, and in this case is possibly the most critical operation of all. On the treatment in this department depends the success or failure of the effort to produce a satisfactory fabric. In order to avoid any danger of impairing the appearance of the white stripe, it would be advisable to scour the pieces before they are taken to the fulling mills. The scouring is an operation which requires considerable care. The pieces are placed in the machine with an end of each through a "pol eye" or guide, which compels them to assume the form of a rope. In this shape they run between two heavy, hard-wood rolls, which squeeze the soap, water and dirt out of the goods. A run of 20 to 30 minutes in warm soapsuds, with one-half to three-quarters of an hour's rinsing should leave the goods perfectly clean. They should then be extracted and dried before fulling, though many finishers consider that it is unnecessary to dry after scouring, if the goods are to be fulled immediately. Much depends on conditions found in the various mills and also on the fabrics to be finished. In the case of heavy goods a thorough extracting may be sufficient, but with very light goods there is danger of running them too wet if the drying is dispensed with at this point. A soaping machine, which will give equal distribution of soap to all parts of the piece, is well-nigh indispensable on light fabrics which require but a short time in the mill. If soap is applied in the ordinary manner, by means of the soap boxes at the back of the mills, there is great danger that it will not reach equally all parts of the pieces, and uneven fulling will be the result. The soap used should be of some standard make, with a fairly good body and absolutely neutral. In extremely warm weather it may be necessary to open the doors of the fulling mill to prevent excessive heating of the pieces. The result aimed for is to secure a good close felt on the pieces which will appear smooth and lustrous when finished. When well felted the goods are washed, extracted, and taken to the

Nappers Without Drying.

Unless the pieces contain a considerable amount of moisture, the napping will be a failure, as the action of the teasels, or wire, on a dry fabric, instead of producing the desired effect, which is a close, smooth, well-laid nap, will result in forming a rough, uneven surface that it will be impossible, by subsequent treatment, to put into proper condition to permit of giving the finish desired. By means of the moisture contained in the goods the fibres are rendered soft and pliable, so that they are easily combed out into a thick, velvety felt, without tearing them loose from the body of the fabric. The method of producing the nap on the surface of the fabric has been changed materially from the tedious process known to our ancestors. In the olden times it was customary to stretch the goods between two supports and teasel them by hand, an extremely slow and laborious operation, and one which gave uneven results. Then came the single cylinder gig, which consisted essentially of a large cylinder, with suitable means for fastening the teasels to its surface and rolls, by means of which the cloth could be made to pass up and down in contact with the teasels. Later, the double cylinder gig was introduced with guide rolls working on a rack and pinion. By means of this improvement, it was possible to give four contacts with the napping surface during the passage of the cloth through the machine. Then came the invention of the wire napper, which

enables the work to be done in a fraction of the time that it formerly took, and means for changing the speed of the napping rolls so that the action may be severe on goods requiring harsh treatment, or gentle enough for treatment of the finest broadcloths.

Even to-day there are many finishers who consider that the final treatment of the goods should be with the teasel gig, claiming it is possible to secure results that are impossible of attainment with the wire napper. The final laying of the nap, after treatment on the cropping shear, to clip off the irregularities, is by means of the wet gig or brush. This machine in appearance is very similar to the ordinary gig. The lower roll, on which the cloth is wound, is a perforated cylinder with both steam and water connections, so that either steam or water can be forced through the fabric while on the roll. By alternately

Forcing Steam and Cold Water

through the pieces they are given a luster similar to a piece of silk. The use of a hydro extractor should be dispensed with after the nap has been well laid and the luster developed and the water driven out by means of a substitute which will give excellent results. To avoid disturbances of the nap, which results from the use of the ordinary type of extractor, the pieces are wound on a 12-inch screen covered cylinder which may be revolved at a high rate of speed, which throws out the water by centrifugal force, but leaves the goods in perfect condition for the dryer, and without a wrinkle. The rolls are placed in a rack on wheels and taken to the dryer. When dry they should be brushed, pressed, examined and rolled up for market.

LAYOUT.

3,168 ends; 15 reed, 3 in dent = 70.4" + 1½" for listing = 71.9" over all.
86 picks.
Dressed 1/30 white worsted, 11 spools, 48 ends ..... = 528
*6
3,168

*Sections.

Filling, 1/30 white worsted...	1	1
6 run black wool.....	1	1
		2

CALCULATIONS.

3,168 ends 1/30 white = 3.02 oz. + 7% take-up ..... = 3.24 oz.

43 picks 1/30 white = $\frac{71.9 \times 43}{30 \times 560 \div 16}$ = 2.94 oz.

43 picks 6 run black = $\frac{71.9 \times 43}{600}$ = 5.15 oz.

Loom weight ..... 11.33 oz.

COST.

6.18 oz. 1/30 + 5% waste = 6.5 oz. @ 82c. per lb. ..... = $ .3331
5.15 oz. 6 run + 15% waste = 6.06 oz. @ 60c. per lb..... = .2475

Cost of stock ..... $ .5806
Manufacturing, 86 picks..... = .4000

Net mill cost ..... $ .9806

12 harness, straight draw.

CROSS-DYED WORSTED SUITINGS

For many years the production of goods composed entirely of worsted in colored patterns was considered impossible except by means of using either skein-dyed or stock-dyed yarns. With the improvements in the art of dyeing, and experiments carried on by manufacturers and chemists, it was found that by using part of the yarns skein-dyed in fast colors it was possible to piece-dye the goods, thus obtaining many color combinations without increasing the number of skein-dyed yarns to any material extent. As time went on, and the chemistry of dyeing became better understood, the possibility of so treating a thread after dyeing that it would be

immune to further coloring became the subject of no little study, with the result that the process commonly termed "resisting" was developed and is susceptible of giving extremely satisfactory results, if performed in the proper manner. By a long series of experiments it was determined that certain coloring materials might be used for dyeing the yarns, which, when given a chemical treatment, would

Not Materially Alter in Shade

during the subsequent piece-dyeing. This discovery rendered it possible to manufacture a great variety of fabrics on the two-loom system that hitherto had required a weaver for each loom, and also appreciably affected the production, as it is well known that yarns in the grey run much better in the loom than either skein or slub-dyed threads. Imperfections are fewer, partly for the reason mentioned and also from the fact that the operative can more easily see and remedy them on white goods. An additional incentive to the manufacturer to use this system is that the white waste produced is more readily salable and at materially better prices than can be obtained for colored wastes. The

Most Important Features

connected with this type of work are: 1. Selection of the proper dyestuffs for the resisted thread. 2. Careful and correct treatment during the resisting process. 3. Selection of dyestuffs for the piece-dyeing that are least liable to affect the resist. If these details are given the attention of the dyer, there will be no trouble in obtaining extremely satisfactory results. There are a variety of dyestuffs which may be used on this class of work, and each dyer will select those which he considers suitable for his needs from the offerings of the various concerns from whom he is accustomed to order his drugs. The dyeing of the shades on yarns to be resisted is accomplished in the customary manner, either in a hand tub or a suitable machine. The yarn should be rinsed, then extracted, and is

Ready for the Resist Bath.

To obtain the best results the chemicals used should be of standard quality. A formula used in some of our large mills with excellent results is as follows: Dissolve 30 per cent tannic acid (F.R.C.P.) in water and work the yarn at the boil three-quarters of an hour, and allow to remain overnight entirely immersed in the same liquor, then drain, but do not wash. In a second tub prepare a bath with 8 per cent antimony salts (10 per cent if the bath is long, that is, an excess of water). Work the yarn for forty-five minutes with the bath at 130 degrees Fahrenheit, then drain off and prepare a new bath with 14 per cent tin crystals and 6 per cent muriatic acid (HCl). Work for forty-five minutes at 140 degrees Fahrenheit, then drain off without washing and dry. It may appear to some dyers that it is not advisable to allow the yarns to remain in the tannic acid bath so long, but an experience of several years has led to the conclusion that superior results are obtained in this manner. Whatever the system used,

It Is of the Utmost Importance

that the same routine be followed with every batch or it will be absolutely impossible to secure uniform results, and the finished goods will be far from satisfactory. The yarn when dry is wound on six-inch spools, and may then be transferred to jack spools, or used as the exigencies of the case require. Should the mill have an equipment for worsted spinning, it would be well to spool the colored yarns on a spool with the grey, if the pattern does not require the use of a full spool of fancy yarn.

The dressing will not require the use of a wet frame, as the yarns are of sufficient strength to weave without difficulty in the absence of any size. In the weave room it is advisable to provide each weaver with two waste

boxes, one for the colored waste and one for the white, as this will obviate the necessity of sorting the waste after it is collected. When woven, the pieces are perched and measured, every imperfection marked with a chalk free from grease or any impurity which will be difficult to remove in the scouring process. The use of an inferior chalk has caused no little trouble at various times, particularly if the goods are dyed to a comparatively light shade. The writer has seen many pieces on which the chalk marks were plainly discernible after finishing, due to some impurity in the crayon or the use of one that had by some means come in contact with oil. The pieces are perched a second time, the percher standing so that the cloth passes between a good light and the eye; for in this way mispicks, threads out, etc., are very easily discovered. The picks should also be counted at intervals of a few yards, to make sure that the weavers are not producing cloth of a lower texture than it should be, and incidentally receiving more pay than they should have for the actual texture of the goods.

The burlers must carefully remove all the knots and bits of foreign matter, taking care not to break the knots too short, lest the ends shrink back during subsequent processes, leaving the defect known as "pin holes," which will need to be repaired by the sewers. They should also be provided with chalk to mark all imperfections which have escaped the observation of the percher, so that the sewers may devote their whole time to repairing damages, as it is costly to waste time in looking for places needing the attention of their needle. All hard twist ends, cable threads and wrong colors must be removed and replaced with perfect yarns.

Threads Out and Mispicks

must be sewn in and slugs reduced or replaced by a new thread, floats and other imperfections repaired, so that the finished cloth may leave the mill as nearly perfect as is humanly possible. The finishing room, in many ways, is the most important in the whole mill, as it is here that the imperfect work of the other departments is developed and brought to light, requiring no little skill to remedy it, which is many times an impossibility. Lack of skill in the treatment of fabrics in the washer, the fulling mill, or the crabbing machine will so affect them as to require their being sold as seconds, while if properly taken care of in the finishing room, the conscientious work of a competent man will, in many instances, add several cents a yard to the selling price of the fabric. The finishing of resist-dyed fabrics does not differ essentially from the process used for ordinary piece-dyed goods. When ready for scouring, the pieces are placed in the common type of washer, through which they pass in rope form, between two heavy rock maple rollers, which effectually cleanses them. The first bath is made up with about two pails of soft soap to the piece, and sufficient warm water to submerge the greater part of the cloth. After twenty to thirty minutes' treatment in this bath, the dirty suds are run off, and the pieces rinsed for one-half to three-quarters of an hour, or until every trace of soap is removed. It is very essential that goods for piece-dyeing

Should Be Absolutely Clean

and free from soap, or the dyeing will be extremely difficult. In fact, the majority of instances of shady goods may be traced directly to improper handling in the wet finishing. From the washers the pieces may be taken direct to the crabbing machine. There is considerable difference of opinion among finishers as to the relative merits of the old-style two-hole Yorkshire crab and the newer type of continuous crabbing machine, but for these fabrics, the latter type is growing in favor very rapidly, and is used by several of the larger mills that specialize on cross-dyed cloths. The advantages are in part the increased production and the elimination of a large part of the labor incident to the use of the old-style machine. From the

crabbing machine the pieces may be taken direct to the dyehouse and colored in kettles holding from four to sixteen pieces.

The dyeing will require the use of special colors adapted particularly for this class of work. At the present time, the necessary drugs may be purchased from any of the reliable houses, they having tested out a series of colors that will not affect the resisted threads. Before using a new lot of resisted yarn for warps, a small sample should be sewed into the end of a piece to be colored, besides a sample of the original. In this way it is possible to determine just how it will appear when used in the goods. It is good practice to require the dyer, when he considers the shade correct, to

Submit a Small Sample Before

the kettle is drawn off. This may be dried and run through the press, then compared with a reference sample, and if pronounced satisfactory, the kettle is drawn off and the piece dried. When dry, the pieces are brushed and sheared, then taken to the fine sewers, who will repair any damages that have not previously been attended to. Before pressing, give a run on the dewing machine, as the finish is made more permanent by such treatment. A final inspection after pressing, comparison with reference sample for shade, and the goods are ready to be rolled up. The method of cost figuring given with this fabric is a form in general use in many mills, and is worthy of adoption, as it gives even better results than the method of figuring by the yard. In this system the total yarns required for a piece are figured, and may be easily verified by weighing the loom beam empty than when the warp is beamed.

LAYOUT.

3,240 ends 12½ reed-4 per dent=65"+1½" listing=66½" over all.
46 picks 2/24.
Dressed 64 yards, woven 60 yards, finished 59 yds.

2,808 ends 2/22 white	
108 ends 2/24 cable twist (white)	
324 ends 2/22 resist	
3,240	

COST.

$\frac{2,808 \times 64}{22 \times 560 \div 2}$ = 29.2 lbs. @ 75 cents = $21.90

$\frac{108 \times 64}{24 \times 560 \div 2}$ = 2.07 lbs. @ 79 cents = 1.63

$\frac{324 \times 64}{22 \times 560 \div 2}$ = 3.42 lbs. @ 95 cents = 3.25

$\frac{46 \times 66.5 \times 60}{24 \times 560 \div 2}$ = 27.5 lbs. @ 76 cents = 20.90

62.19	$47.68
3% Waste	1.41
Cost of stock	$49.09

49.09÷59 yds. finished = $.832 per yard.
Labor and incidentals .275

Net mill cost $1.107

8 harness straight draw.
4 harness twill.

COTTON WARP SHIRTING FLANNELS

A fabric that is of especial interest at this time is the cotton warp flannel. The new tariff rate, which went into effect January 1, may make a material difference in the prospects of mills manufacturing fabrics of this type, as it is generally conceded that the foreigner is an expert in the production of woolen goods without the use of wool. Fabrics similar to that here analyzed were, not many years ago, the regular production of several of our smaller mills, and, indeed, there were some mills of considerable size that made a specialty of cotton warp cloths. In recent years the market for cotton warp men's wear has grown less and less each year, with the result that at the present time there are

Comparatively Few Mills

engaged in the production of such goods. There is still a moderate demand for shirtings of this character, and we here present the analysis of an 8½-

ounce cloth of this description. As a general proposition, it is safe to say that these fabrics are produced by specialists; that is to say, the plants are fitted with machinery particularly adapted to the manufacture of these cloths, and the whole plant was laid out and arranged with this in mind. The warps of single cotton are invariably purchased on the loom beam, ready for drawing-in and require nothing in the way of preparatory machinery. The filling is prepared from nothing but rag stock, involving the use of absolutely no new wool. Mills specializing on these fabrics are equipped with rag pickers, lumpers, dusters, etc., and invariably purchase the raw materials in the form of rags, rather than in the prepared state. The rags are graded as to quality and colors, the light shades laid aside for making the light-colored goods and the dark clips picked for filling to make the darker-colored cloths. After sorting, the rags are laid out on the floor of the mixing room, a layer of rags possibly four to six inches thick, upon which an emulsion of oil is sprinkled to assist in the picking operation. On top of this another layer of rags which receives a sprinkling of oil, and so on, until the batch is complete. In many mills it is customary to shut up the oiled rags, and allow them to stand for a few days to secure thorough penetration of the whole mass by the oil, when they are laid out in front of the picker and prepared for the cards. A not uncommon arrangement is to have two or three pickers discharge into a common gauze room for the stock which is used in quantity, while a suitable arrangement is provided whereby one or more may discharge into a separate room if stocks of different colors or grades are to be run simultaneously. The emulsion used on the rags is usually prepared by mixing equal parts of oil and water, emulsified with a mild alkali, using from twelve to fifteen quarts to each hundred pounds of rags. The raw stock is shredded into fibre form by means of a rag picker, a machine consisting essentially of a travelling feed apron, fluted feed rolls, a main cylinder, and a funnel at the back to conduct the shoddy from the machine. The cylinder, the

Most Important Feature

of the machine, is enclosed in the frame work and is built in various sizes, a very common size being 18 inches long and 42 inches in diameter, containing from twelve to fourteen thousand iron teeth. The usual speed is from 650 to 800 revolutions per minute.

The rags are fed to the travelling apron, conveyed to the feed rolls, and on emerging from them are engaged by the teeth of the cylinder, which tear them into a fibrous, woolly mass which is discharged into the gauze room. Any hard lumps or pieces of cloth not thoroughly torn to pieces fall into a receptacle suitably provided, and are again placed on the feed apron for a further operation. The upper feed roll is maintained in position by springs, which, in case of overloading, permit the roll to rise, delivering the rags to the cylinder and preventing choking of the machine. Carding and spinning are performed on the same type of machinery used in the production of ordinary woolen yarns, except that in the majority of instances the first breaker card is

Provided With a Metallic Breast.

This consists of a set of rolls covered with steel-toothed clothing, which reduce the bits of thread to fibre, which have not been thoroughly opened by the action of the picker. The weaving is invariably on the two-loom system and requires no description. In finishing this type of fabrics, it is customary, in the case of the heavier weights, to give them a thorough treatment on the wire napper before fulling and to full in the grease. The light weights similar to the fabric under analysis will not need this preliminary treatment, but may be taken to the fulling mills immediately after burling.

The soap used must be full-bodied and will require a considerable strengthening with alkali, as the goods contain a much greater proportion

of impurities than fabrics composed entirely of wool. From the fulling mills the pieces are taken direct to the washing machine and well scoured with warm water. It will probably require rinsing and a second soaping to thoroughly cleanse the goods. From the washer the pieces may be taken to the dyehouse without extracting and colored with a union dye which will color both wool and cotton a uniform shade, at the same time covering up any specks of vegetable matter contained in the stock. When colored, the goods are cooled off and rinsed in the dye kettle, extracted and dried. A few runs on the brush will put them in condition for the shear. The fly blade must not be set too low, as all that is required is to even up the nap, and too close shearing will destroy the desired effect. Unless a certain amount of nap is left on the face of the goods, the cotton warp will be too apparent and the handle be materially impaired. A light brushing is required before pressing, then a final inspection and the goods are ready for market.

LAYOUT.

2,240 ends; reed 8½—4 = 66".
36 picks.

CALCULATIONS.

2,240 ends 1/16 cotton = 2.67 oz. +
10% take-up .....= 2.86 oz.

36 picks 2¼ run = $\frac{36 \times 66}{225}$ .....= 10.53 oz.

Loom weight ..... 13.39 oz.

COST.

2.86 oz. cotton + 2% waste = 2.92 oz. @ 22c. per lb.	=	$ .0400
10.53 oz. filling + 20% waste = 13.16 oz. @ 8½c. per lb.	=	.0699
Cost of stock		$ .1099
Manufacturing, 36 picks	=	.0800
Net mill cost		$ .1899

Selling price 26 cents net.
4 harness, straight draw.
Plain weave.

FANCY NUB CHEVIOT

Fabrics of this type have been extremely popular for use in children's suits and overcoats for some years. In the recent past they have been used extensively for men's raincoats and topcoats, making a particularly stylish garment, one that retains its shape and is of but little weight. Fabrics used for children's wear are usually made from relatively fine yarns, with a small nub, while the overcoating cloths are made from coarse yarns decorated with nubs of considerably larger size. The yarns used in the finer cloth are usually made from a medium grade of wool spun to about three run. The nubs are made from a short, curly wool, usually the scoured and carbonized defective Californias, as these are ideal for rolling in nubs. A few years ago it was customary for the carder who was about to make nubs, or knickerbocker as it was often called, to screen off a set of cards, so that no one might have an opportunity to learn the method employed in making the nub. At that time it was a process understood by comparatively few carders, and it is probably safe to say that, even at the present time, there are carders in some of our mills who have never made nubs or have never seen them made.

The process is extremely simple, requiring nothing in the way of accessories or attachments to the ordinary first breaker card. The

Method of Procedure

followed by most carders is to set off the doffer comb, or remove it entirely, raise the workers by placing under the bearings in the poppet head a piece of leather cut from an old belt and set off the doffer possibly an eighth of an inch. The wool is placed in the self-feed as for ordinary carding, and the machine started. Instead of the carding process which usually takes place, the wool is rolled into small pills or nubs, which fall to the

Overcoat Made from Fancy Nub Cheviot.

floor at the delivery end of the card. The size of the nub is changed by the varying thicknesses of the leathers under the worker bearings. It is common practice to make the nubs in the white and afterward dye them to the desired color. This method is pursued in order to avoid cleaning the card between lots of various colors. The finished nubs are dyed in the ordinary open wool-kettle with a false bottom. To avoid having the nubs pass through the holes in the false bottom, many dyers take the precaution of covering the bottom of the dye-kettle with burlap. If it is desired to have the nubs retain their form to the fullest extent when in the goods they may be hardened somewhat by fulling.

To accomplish this they are placed in a bag, wet up with soap solution and put into an old type

Pusher Mill

or into falling stocks. The modern type of rotary fulling mill is not as well adapted to this work, although it may be used by sewing up a tube of burlap or other fabric, placing the nubs inside and running in the mill for a short time in a similar way to a piece of cloth. Nubs so treated will not lose their shape to any great extent in subsequent operations.

There are different methods in vogue of putting the nubs into the yarn, but the one in most common use, probably, is to mix them with the stock at the picker. This method has been found to give excellent results in mill practice, while the method, used in few instances, of introducing them on the finisher card is apt to give rather uneven results. The wools used for the manufacture of such fabrics should be of good length, well scoured, and those to be used in the white should preferably be bleached, though if a careful selection is made in the sorting room, perfect results may be obtained without the bleaching process. It is essential that the stock should be thoroughly opened and mixed in the picker room, as it is obvious that comparatively little carding can be done on such yarns if the nubs are to keep their shape and size. The workers must be set well off from the cylinder on the first and second breakers, those on the finisher may be somewhat closer, but not sufficient to destroy the desired effect.

In spinning, these yarns

Do Not Require Special Treatment.

The roving for the finer counts should be made about half draft, while that for the heavier counts will need to be relatively finer from the card. The spooling should be carefully attended to, knots tied in such a manner that they will not slip in dressing and weaving, spools be free from holes and slack ends. With yarn properly spooled, the dressing room should show an extremely high percentage of efficiency, as the warps may be dressed without size and the reel operated at a relatively high speed.

The production per loom should be well over 80 per cent of the possible output if the warp yarns are well made with filling properly spun. One great cause of low weave room production is the lack of care in the spinning room in making the filling. Frequently the yarns are not wound with sufficient weight on the counter faller to make a bobbin that will not knock off in the shuttle, causing a loss of time for the weaver and an undue amount of waste. The fixer can do much toward avoiding this trouble by proper adjustment of the power and the binder springs. A shuttle check, properly adjusted, will also assist materially in reducing the waste from this cause. It may be necessary to inform the burlers that the "specks" are intended to remain in the fabric, as an instance, well authenticated, is told of a new girl in the burling room working faithfully to remove all the colored nubs. There should be practically no sewing required on fabrics of this type, and an inspection after burling may enable the finisher to send many pieces direct from the burling room to the fulling mills.

The greater part of these fabrics are fulled but little, probably not over an hour at the most. The soaps used should be of good quality and of sufficient strength to start the grease and dirt freely in the mills. Full to 56 inches, with no endwise shrinkage, and scour as soon as possible after removing from the fulling mills. If the soap used in fulling was of the

Correct Consistency

and strength it will not be necessary to add a further quantity in the washer. Run in warm water for 20 or 30 minutes, then rinse thoroughly before removing them for extracting. A very common mistake is made at this point in the finishing of nearly all woolen and worsted fabrics, that is, there is too great anxiety to get them dried in the shortest possible time, the result being that they are extracted more than they should be, going to the dryer without sufficient moisture to get the full effect of the drying operation, and dried too rapidly for the best results by means of an excessive temperature. The superior "feel" of a fabric dried in the open air is probably familiar to all of the older generation of manufacturers. This is not to be attributed to any greater virtue of the outdoor air, but simply to the fact that the goods are dried naturally, slowly and without excessive heat. It would be policy to operate the dryer overtime, or to increase its size rather than to secure greater capacity by raising the temperature in the drying chamber. When dry, the pieces are given a light run on the shear to remove the long hairs. Give a run on the dewing machine, press with a little steam on the face as they emerge from the cylinder. Roll up tightly and do not perch until next day.

Used for Raincoatings.

Many of these fabrics are made up into raincoats, and are waterproofed either by the manufacturer or buyer. The process of waterproofing is comparatively simple, and may be carried on at slight expense by the mill if it is so desired. The process consists of impregnating the fabrics with a mixture that repels the moisture. The methods in use in our mills may be classified as wet and dry. In the wet method, the proofing mixture is usually applied in the washer after the goods have been well rinsed, and consists of a solution of lead acetate and other chemicals. The dry method is accomplished by treating the fabric with a preparation of paraffin wax just prior to its entering the press, where the heat and pressure effect the thorough permeation of the fibre with the proofing mixture. A still later method consists of dissolving the wax and other materials in benzine and running the fabric through this bath, afterward recovering the benzine.

LAYOUT.

2,160 ends; 7½ reed, 4 per dent = 70" + 1½" for listing = 71½" over all.
30 picks.

STOCK.

85% med. wool @ 40c.	= $ .340
15% nubs @ 50c.	= .075
	$ .415

$.415 = 16 ÷ $.0259, cost an ounce.

CALCULATIONS.

2,160 ends 3 run = 7.2 oz. + 10% take-up = 8.00 oz.

30 picks 3 run = $\frac{30 \times 71.5}{300}$ = 7.15 oz.

Loom weight 15.15 oz.

Finished weight 13-13⅛ oz.

COST.

15.15 oz. + 15% waste = 17.82 oz. @ $ .0259	= $ .4616
Manufacturing, 30 picks	= .2500
	$ .7116

CHECKED CHINCHILLA

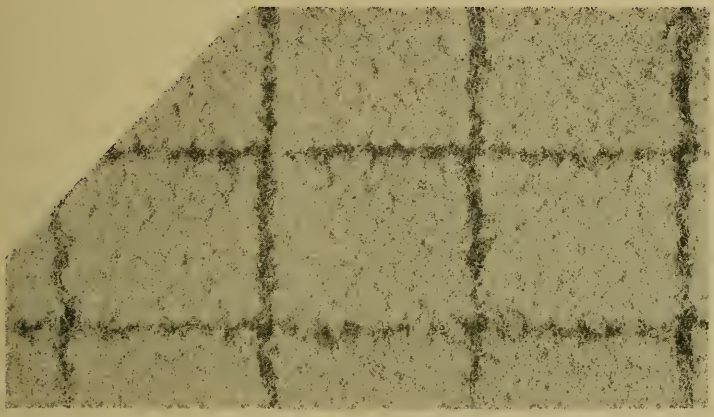
This is a fabric especially adapted for the manufacture of ladies' and misses' short coats, and is produced in lighter weights than the chinchillas

intended for men's wear. They are made in a variety of colors and different sizes of checks, one of the most popular styles being a white ground checked with light green, the pattern measuring three-quarters by one inch. The production of fabrics of this character in white grounds should not be undertaken by any mill unless they have preparatory departments that are entirely distinct and separate from each other. The operation of a set of cards on

Colored Stock in the Same

room with those running white stock cannot be successfully carried on, as the fly from the colored work will spoil the white or vice versa.

Screening off a section of the room with burlap or other material will essentially assist in keeping the lots separate, but if the best results are to be obtained, it will be necessary to have a separate picker and card room for the white work. The extra labor involved in an attempt to keep the white free from specks and fibres of colored stock while making other goods and the extreme probability of making seconds would deter many mills from trying to make white cloths. That greater profits are to be made on such fabrics is true, but there are many features connected with



Checked Chinchilla.

their production that practically eliminate them from the lines of a great many of our mills that otherwise might be able to manufacture them successfully. In some cases the

Natural Conditions

will not allow of their production, the water may not be sufficiently pure, or the proximity of other manufacturing establishments may so fill the air with smoke and other impurities that it is impossible to keep the fabrics clean while in process.

The stock used may be a straight wool or a blend of wool and noil, the latter producing a fabric that will give excellent service and prove satisfactory to the wearer. Care in selection of the stock is essential, as the slightest discoloration in the wool will injure the salability of the goods. If noils are used they must be thoroughly carbonized and freed from impurities of every kind before they are mixed with the wool.

The stock used for the sample here described is a three-eighths territory blended with an equivalent grade of noil for both warp and filling. The lots are chosen particularly for their color and freedom from yellow tips.

The sorting is not as important an item on these fabrics as in the case of fine cloths, but should not be slighted.

Scouring Important.

The scouring must be done with great care, as serious injury may be done the stock in this process, not only detracting from the spinning qualities of the wool but materially affecting the color. In order to obtain the best possible results the scourer must use only the best of materials for cleansing the wool. The soap should be tested for impurities of various kinds and for the presence of free caustic alkali. The presence of the latter is really a more serious affair than many of the other impurities, as most of them do no particular harm, aside from increasing the expense, while the free caustic has an extremely injurious effect on the structure of the wool fibre itself, and if present in sufficient quantity will entirely destroy it. Certain soaps also have a tendency to give the wool a slightly yellow tinge and should be carefully avoided, as it is desired to bring out the finished fabrics a pure snow white. Another factor, often lost sight of, is the fact that excessive heat in the drying

Injures the Working Qualities

of the wool and tends to give it a more or less pronounced yellow tinge. To obviate this, the cold-air method of drying should be employed. By this system the moisture is removed from the wool without the assistance of artificial heat. The necessary appliances are a series of drying racks with enclosed bottoms. The wool to be dried is spread on the screens and air at the ordinary temperature is either drawn down through the wool by exhaust fans connected to the enclosed space under the screen, or preferably, the air is forced up through the wool. The latter method will give more rapid results, and leave the wool in somewhat better condition for subsequent operations, as the passage of the air in an upward direction tends to open the wool and make it more lofty.

To secure absolutely even results at all times, it would be advisable to bleach the wool, as even with the greatest care it may be impossible to secure wools of even color at all times. The bleaching process in common use is not especially difficult, nor does it require an installation of expensive equipment. Of the ordinary methods, either the

Peroxide or Bisulphite

bleach may be carried on in an open dye-kettle, the former bleaching agent being one used in many mills with very satisfactory results. It is essential that the wool be perfectly clean and free from all fatty matter before treatment. The bath for 300 pounds of wool is prepared with: 400 gallons hot water, 10¾ pounds sulphuric acid, 9 pounds ammonium phosphate and 9½ pounds sodium peroxide. A very important factor of success in the use of this method is the degree of alkalinity of the bath. In the majority of instances it will be found necessary to vary the bath to suit the stock to be bleached. Should the bath appear too strongly alkaline, a small quantity of phosphoric acid may be used to correct it, using litmus paper as an indicator. The proper alkaline condition is indicated by the bath showing a slight bluish tinge. Should the acidity of the wool neutralize the alkali, the addition of a small quantity of ammonia will restore the correct condition. The bath should be allowed to stand for 20 minutes before using, and the foam which forms on the surface must be skimmed off before entering the stock.

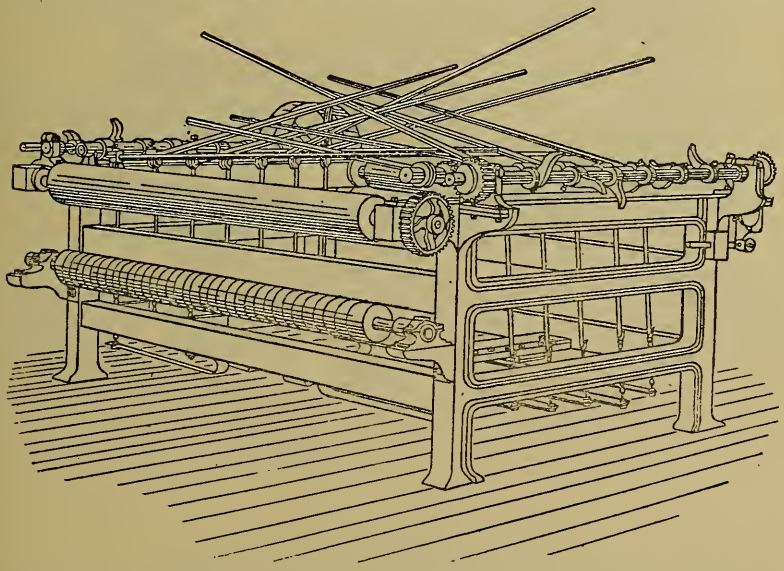
This method requires more care and attention than the use of bisulphite, for which a formula was published in another article. To retain the purity of color of the bleached stock will require the utmost care in every department. The picker must be free from every trace of colored fibres, and if a pneumatic conveyor system is used it should be thoroughly inspected

and cleaned before it is used for the white wool. Have the floor of the picker house and the card room bins immaculate before starting the lot. Mix well, oil and give two runs through the mixing picker, then card carefully, making the roving slightly over half draft. This should insure work that will run well on the mules and produce a strong, even thread. Have the warp yarns well spooled, no holes, loose ends or long knots, and the dressing will proceed with no difficulty whatever. In preparing the looms for white warps the fixers should use due caution to

Prevent Any Oil Dropping

from the various moving parts to the warp or on the woven goods, and it may be necessary to caution the weavers about wiping the shuttle on the fabric. For this purpose it is well to wind a fairly wide heading around the breast beam near the shuttle changing end, on which the weaver may rub the shuttles to remove any dirt or oil that has collected. Burling should be carefully performed on every piece, and an inspection after burling may permit of many pieces going to the fulling mills without passing through the hands of the sewers.

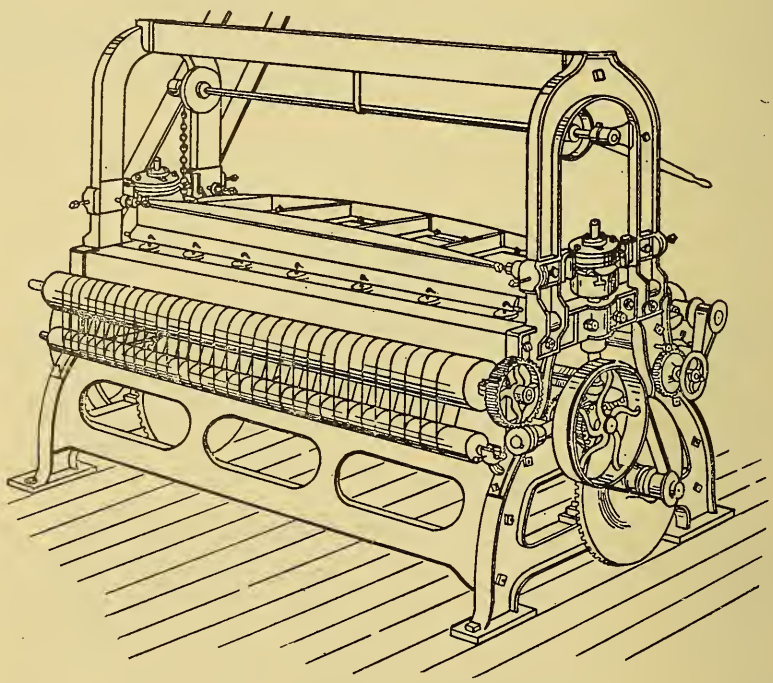
The fulling of white goods must not be attempted with an inferior soap, nor one that is built up with a harsh alkali or an injury to the color may



Kinyon Bros. Whipping Machine.

result. The soap should be of high grade, full bodied, built up with a mild alkali and of sufficient strength to saponify and hold in suspension through the fulling and scouring all the dirt and oil contained by the goods. Full to 57 inches, scour with warm water for 20 to 30 minutes, then rinse thoroughly, extract and place on the dryer. The napping necessary to cut the loops formed in weaving, which are later to be rubbed into the nubs or spirals,

giving the characteristic appearance to the fabric, should be performed with the fabric damp, but not wet. In this condition the nap may be raised without undue waste of material. The amount of gigging required is dependent to a certain extent on the type of finish required, that is, the size of nub it is desired to form, though this is also governed considerably by the throw of the cams on the upright shaft of the chinchilla machine and the shearing. Many chinchillas are so constructed as to obviate entirely the necessity for fulling, particularly those intended for ladies' wear, as fulling tends to produce a more boardy fabric than is desirable for such use. In this case the soap should not be of such heavy body as ordinary fulling soaps, but must be heavier than soaps usually made for scouring. A very satisfactory com



Kinyon Bros. Chinchilla Machine.

pound for this purpose may be made with two ounces of pure neutral palm oil soap and three ounces of alkali per gallon of water. The

Heavier the Soap Used

the more time is required for removing it, and on these goods, as on all others, it is essential that every trace of soap be washed out. A good soap and plenty of warm water will accomplish the desired result. After washing, the goods are extracted and taken to the gig.

This is, perhaps, the most important operation of the whole finishing process, as on the production of a full, heavy nap, well worked up from the

bottom so as to be free from streaks and cover the threads completely, depends the success of the subsequent operations. The use of the old fashioned up-and-down gig for this work is much to be preferred, as there is less danger of injury to the fabric. When the napping is about completed, the pieces are taken off and placed on the cropping shear. The omission of this operation will result in a lack of evenness which cannot be remedied in any other process.

The shear should be fitted with a wire raising brush in order to effectively perform its functions, and the laying brush should be removed. The shear should be in A1 condition, so that one run will suffice to cut the nap evenly, all that is necessary being to

Square the Nap,

leaving as long as the type of finish demands. The goods are then again placed on the gig and the napping completed. In order to put the nap in the best possible condition for further processes the goods are run over a whipping machine before drying. The machine consists of a framework to which are attached 13 slender rods of tough wood, actuated by levers and cams. The fabric to be treated passes over the framework, face down, the rods beating on the back of the moving cloth, bringing the nap into an erect position. The whipping machine should be so arranged that the goods immediately go to the dryer with no handling or folding. A special type of dryer is used in which the goods come in contact with anything but the supporting pins at the sides. When dry, the goods are again sheared, taking into consideration the size of "nub" desired. If a large nub is intended, the nap must be left long, while if a close, fine nub is required the cloth must be sheared closer. Uniform napping and even shearing are essential if the best results are to be obtained.

The nubs are formed by the chinchilla or "Whitney" machine. The bed plate is rigidly fastened to the framework of the machine about three feet from the floor, is of hard wood and covered with a good grade of Brussels carpet, firmly glued on. On each side of the plate is a roll covered with card clothing, serving to draw the cloth across the bed plate. Above the bed is another plate of similar shape and size, but made of cast-iron and covered with a solid plate of rubber cemented on the under side. This is termed the "follower," and may be raised or lowered by suitable chains and handle. The follower is driven by an upright shaft at each end, provided with cams to produce the various motions required for different types of finish. The machines are capable of

Five Distinct Motions,

each producing its special effect on the goods. The operation of the machine is comparatively simple. The piece is put on the bed, attached to both delivery and take-up rolls, the follower lowered so as to touch the nap, the machine started and the nub begins to form immediately. On the ordinary grade of chinchillas, one run through the machine is all that is required, the backs are brushed and the piece is ready for the final inspection. On the finer grades the pieces are sheared after the first run, and the nubs cropped to the desired size. During this operation the raising brush must not be allowed to come in contact with the piece. A second run will give a fine, close nub, frequently called a "pin head." Brush on the back, examine carefully to see that the nubs are even, measure, roll up and pack.

LAYOUT.

1,560 ends; 11 reed, 2 per dent = 71" + 1½" for listing = 72½" over all.

48 picks.

STOCK MIXTURE.

60% wool @ 44c..... = $ .264
40% noil @ 36c..... = .144
$ .408

$.408 ÷ 16 oz. = $.0205, cost an ounce.

Dressed:

2½ run green.....	2		2
2½ run white.....12		16	28
			30
			13
			390
			*4
			1,560

*Sections.

Filling:

2½ run green, H. T...		2	2
1¼ run whlte.....	1		23
2½ run white.....1			23
	23×		48

CALCULATIONS.

1,560 ends 2½ run = 6.24 oz. +
10% take-up ..... = 6.93 oz.

$$24 \text{ pks. } 2\tfrac{1}{2} \text{ run} = \frac{24 \times 72.5}{250} \quad \ldots\ldots = 6.96 \text{ oz.}$$

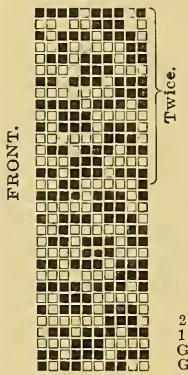
$$24 \text{ pks. } 1\tfrac{1}{4} \text{ run} = \frac{24 \times 72.5}{125} \quad \ldots\ldots = 13.92 \text{ oz.}$$

27.81 oz.

COST.

27.81 oz. + 15% waste ..... = 32.72 oz.
32.72 oz @ 2.05c..... = $ .6708
Manufacturing, 48 picks..... = .3240
Net mill cost..... $ .9948

WEAVE.



DRAW.

PLAID BACK LLAMA OVERCOATING

This fabric derives its name from the animal which produces the particularly soft stock of which the face of the cloth is composed. The Llama, the Alpaca and the Guanaco are all indigenous to the mountainous regions of South America, the first two being species of the same family and producing quite similar fibres. The production of this stock is limited in quantity, and is used only in the manufacture of special fabrics, in which softness and luster are combined.

The fabric analyzed is finished with considerable nap, which, instead of being laid perfectly straight as in a zibeline or kersey, has a very perceptible ripple effect, the result of treatment on a special machine during the process of finishing. One of the chief reasons for the lack of success in operating our carded woolen mills is the aversion of many of our manufacturers to

Introduce New Machinery

or new processes, particularly in the finishing room. They seem perfectly satisfied to follow the procedure mapped out by their predecessors, using

in many instances machinery that should long since have been relegated to the scrap heap. The great wonder is that they have been able to survive until the present, the possibilities of making a profit having been eliminated long ago. The progressive mill owner is ever on the alert to gain a knowledge of newer and more efficient methods of performing the various operations incident to the conversion of raw materials into finished merchandise, and to keep abreast of the times by

Changing the Character

of his product to conform to the ever changing demands of fashion. The idea that any machine which can be operated without danger of falling to pieces is good enough for the manufacture of woolens has apparently governed the actions of many managers, with the inevitable result that the quantity and quality of production has steadily been reduced until it has reached the place where a relatively large expense for replacement of worn out machinery must be incurred in a short space of time that normally should have been distributed over a series of years.

It is unfortunately true that most of the ills which have befallen the carded woolen industry may rightfully be attributed to the manufacturers themselves rather than to influences outside of the manufacturing end. The truth of this statement is borne out by a few notable exceptions which amply disprove the oft repeated remark of the incompetent that there is "no money in woolen manufacturing."

Profits Dependent on Management.

The returns from any form of manufacturing enterprise are more largely dependent upon the economical and efficient management of the plant itself than upon outside conditions, though there are exceptional periods when the highest type of management is unable to combat successfully a combination of conditions which tend to reduce profits to the vanishing point or even create a manufacturing loss. At such times the plant whose equipment and organization is thoroughly up-to-date in every particular is able to weather the storm with much less impairment of resources than its neighbor, who even in normal seasons has a struggle to show a balance on the right side of the profit and loss account.

The foregoing does not imply that in all cases the purchase of secondhand machinery is to be deprecated, as in many instances it is possible to secure from the second dealers machinery that is practically as good as new, or at least will

Answer the Purpose

fully as well. It must be understood, however, that if secondhand equipment is bought, it should be thoroughly inspected by an expert, and not taken merely on the dealer's statement as to its condition. A very common mistake in estimating the cost of fabrics is the making of too small an allowance for depreciation. This is frequently the case with a concern which has secured an old mill at a comparatively low price. It is customary to allow five per cent for depreciation, but this item must be materially increased if actual results are to be obtained, as five per cent on the purchase price will not form a reserve of sufficient size to replace the machinery when its days of efficient service are over. In no branch of the industry is the necessity for modern equipment and manufacturing ability more strongly apparent than in the production of novelties, and in no department of the textile field is there greater opportunity for the earning of a very satisfactory profit. To obtain the latter result it is essential that the organization at the mill should be competent to produce the fabrics, and

More Important Still,

that the selling organization, and particularly the styler, should be thoroughly conversant with style tendencies, and have the ability to direct the

efforts of the designer toward the development of desirable fabrics, styles and colorings. The two organizations are interdependent and must co-operate if success is to be the reward of their efforts.

To properly construct a fabric such as is here described the stocks used for the "shell" or face and the back must possess similar felting properties, as otherwise the two cloths will not work together in the fulling mills, and a cockly, unsatisfactory fabric will result. For this cloth the face filling mixture is made up from 60 per cent of a three-eighths territory clothing wool and 40 per cent of Alpaca noil, giving a softness to the fabric that is its chief characteristic. The face and back warp and back filling are made from a mixture containing 70 per cent of three-eighths wool and 30 per cent of fine shoddy. The wool must be well sorted and carefully scoured, the latter process being carried on with soaps and alkalis that will in nowise

Detract from the Strength

or working qualities of the fibre. Another very important feature of the scouring is the nature of the water used. It is a fact probably known to most, if not all, who are familiar with the handling of wool, that it is practically impossible to satisfactorily cleanse the fibre if hard water is used in the scouring bath. This is due to the fact that the mineral salts contained in the water are disintegrated and uniting with the fatty matter in the soap, which is also decomposed, form an insoluble soap which is deposited on the wool in the form of a sticky, pasty substance, whose subsequent removal is attended with no little difficulty. Its entire removal is necessary, however, or future operations are rendered almost, if not quite, impossible. This is particularly true of dyeing, level shades being an utter impossibility on wools in this condition. If a supply of soft water is not obtainable it becomes necessary to soften the available supply by mechanical or chemical means. The cheapest

Method of Softening Water

for wool scouring is to precipitate the mineral compounds with caustic soda. To each 1,000 gallons of water from three to five pounds of caustic soda should be added, the quantity depending upon the degree of hardness of the water. Both temporary and permanent hardness are removed by this method, and equally good results are obtained with either hot or cold water. The lime, magnesium or iron salts are precipitated as insoluble compounds, leaving the water soft and in condition for use in wool scouring. In drying the wool, the mistake is frequently made of hastening the operation by increasing the temperature, which gives the wool a harsh handle that cannot be overcome in further processes. A better method is to increase the drying facilities or operate this department overtime. In the picker room the

Mixing and Oiling

of the lots must be carefully attended to, or uneven and unsatisfactory yarns will result. In laying out the lots at the picker the various stocks should be placed in layers containing approximately the correct proportions of each, and given a sufficient quantity of an emulsion made from an easily saponified oil to properly lubricate the fibres during carding and spinning. The amount required will vary with the nature and quality of the stock, and the mixture used in the production of the fabric described should receive four quarts of oil per hundred pounds.

The roving for the face filling should be made about two-thirds draft, and the finer yarns used in the balance of the cloth should spin well at half draft, making a strong, even thread. In building the chain for plaid backs, it might be well to read "risers" for "sinkers" and vice versa, so as to bring the back of the fabric uppermost in the loom, enabling the weaver to see the more intricate pattern without difficulty. This is nonessential,

and must be governed by conditions existing in each individual mill. Should this be done, however, see that the twill on the back runs in the direction intended. When woven, the pieces should be inspected, measured and sent to the burlers. In this department all knots are removed, slugs and bits of foreign matter taken out and loose threads tightened up. Should there be filling drawn in at the sides, it should be carefully taken out by the burlers without disturbing the other threads. The sewers should have but little work on a fabric of this kind, as with well-made warp and filling breakage in the loom should be very slight. From the sewing room the pieces may be taken direct to the fulling mills and run into the mill single. As the fabrics are

To Have a Soft Finish,

the fulling should be accomplished as quickly as possible with this end in view. The longer a piece is fulled the more boardy it becomes, and this is an undesirable feature in fabrics of the character described. Full to 57½ inches in width, and transfer immediately to the washing machine. The scouring of the cloth is a chemical not a mechanical operation, though many finishers seem to have the latter idea of the process. The cleansing of the fabrics is accomplished by the chemical union of the soap with the grease and other impurities contained in the fabric, and for this reason it is necessary to use a soap of sufficient strength to emulsify and hold in suspension the impurities during the operations of fulling and scouring. If the soap is of the proper body and strength, its vitality should not be exhausted in the fulling, and no further quantity need be added during the scouring. Run for half an hour in warm water, and then rinse thoroughly until every trace of soap is removed. Extract moderately, and place immediately on the up-and-down gig.

The napping operation is one which, while

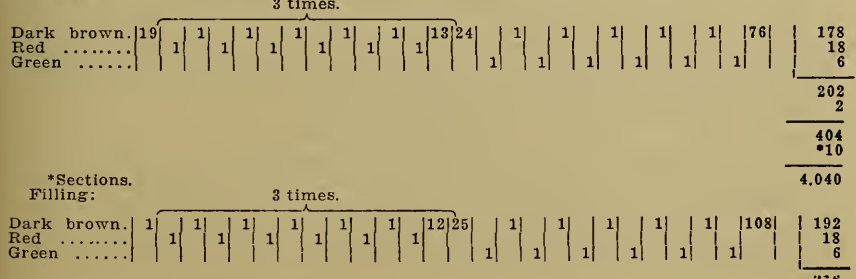
Apparently Very Simple,

requires much care if the best possible results are to be obtained. The process should be started with old work, then a few slats removed and sharper work substituted, and finished with every slat full of new work. When a thick, full nap has been raised, give a run on the cropping shear to square the nap and then dry the pieces. When dry, place on the Whitney machine and give one run to obtain the peculiar ripple effect. If it is desired to finish the back of the fabric with a semivelour effect, the back should be napped while the pieces are wet and before the face has had any work, then nap the face and crop both sides before drying. The goods require no further treatment after the passage through the rippling process, but are ready to inspect and roll up.

LAYOUT. 1½" for listing = 73½" over all.

4,040 ends; 13 reed, 4 per dent = 72" +70 picks.

Dressed:



STOCK MIXTURE.

Warp and back filling:	
70% ⅜ territory @ 44c.	= $ .308
30% fine shoddy @ 20c.	= .060
	$ .368
Face filling:	
60% ⅜ territory @ 44c.	= $ .264
40% alpaca noil @ 48c.	= .192
	$ .456

COST.

10.3 oz. + 20% waste = 12.87 oz. @ $.456 per lb.	= $ .3658
17.66 oz. + 20% waste = 22.07 oz. @ $.368 per lb.	= .5076
Cost of stock	$ .8734
Manufacturing, 70 picks	= .4160
Net mill cost	$1.2894

CALCULATIONS.

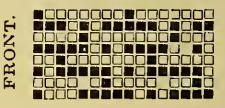
4,040 ends 4 run = 10.1 oz. + 10% take-up = 11.22 oz.

35 pks. 2½ run face = $\frac{35 \times 73.6}{250}$ = 10.30 oz.

35 pks. 4 run back = $\frac{35 \times 73.6}{400}$ = 6.44 oz.

27.96 oz.

16 harness, straight draw.



WOOL AND WORSTED THREE-COLOR HAIR LINE

The true hair line fabric is usually made from fine yarns and closely finished in order to bring out clearly the pattern effect, which would be hardly perceptible were the goods finished with any considerable amount of nap. The pattern is developed in a single thread effect the line resulting from the crossing of each warp end by a pick of filling of the same color, and is invariably woven on the broken crow twill. The imitation illustrated is woven on a rib weave with a warp of three colors, brown, slate and white, two ends of each in the repeat, and woven with a chain that raises all the threads of the warp at each pick, except those of the same color as the pick about to be thrown across. The result is a three-colored stripe, well-defined, and a well-balanced fabric. A similar effect might be produced in a fabric constructed with wool for both warp and filling, the only objection to such a construction being the fact that

Definition of Pattern

is difficult to obtain without clear finishing, because of the very decided tendency of the wool fibres of different colors to overlap and felt together in the fulling process. In the recent past, a woolen fabric, clear finished, of similar construction, has been a very good seller with a number of fancy cassimere mills. The popularity of pencil stripes and other fine effects would lead one to suppose that a fabric similar to that described might be well received the coming heavy-weight season. The yarn for the warp may be made from an all-wool stock or from a mixture of wool and shoddy or noils. The use of shoddy in the white stripe would involve a careful selection of the stock, as absolute purity of color must be obtained or the desired effect cannot be produced. It would not add materially to the cost to use a noil or garnetted thread waste in the stock mixture for the white, making a slight increase in the amount of shoddy in the darker mixtures to overcome the greater cost of the white. The

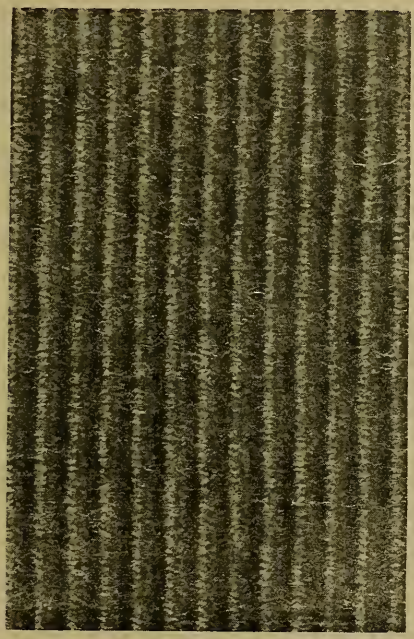
Wools Used in the Warp

should be of medium grade, well sorted, all discolored locks thrown into the lots intended for coloring, and the clear white kept by itself for use in the white thread. With well-selected wools, scoured carefully, bleaching should not be required, but to overcome the slightly yellow tinge to be found in most wools, it might be well to give the white a very small percentage of a thin blue dye, the effect being to overcome the yellow cast and make

the stock a more brilliant white. This process is used by many of our leading mills, and is practiced in our laundries daily. See that the stock is thoroughly mixed in the picker room and given sufficient oil of good quality to thoroughly lubricate it during the carding and spinning processes. The necessity for oiling the stock is due in a large measure to the peculiar physical structure of the wool fibre. To the naked eye a single fibre of wool appears to be a smooth, cylindrical filament, the same size from root to tip. Viewed under a powerful microscope, it is seen to be a hollow cylinder, tapering from one end to the other, and covered with

Innumerable Fine Bracts, or Serrations.

These fine scales give to the wool the greater part of its felting power, and are of material assistance in blending the mass of fibres into a com-



Three-Color Hair Line.

pact whole during the process of fulling. In order to obtain the best results in converting the wool into cloth, it is essential that its peculiar characteristics are preserved to the fullest extent. Under the influence of moisture, the fibre becomes soft and pliable, the serrations are much less liable to be damaged in the process of manufacture, and less waste is made. The emulsion used in the picker room fills these imbrications so that the fibres slip past one another readily, and are not injured by the friction or by contact with the wire clothing of the cards. In addition to the preservation of the structure of the fibre, the oiling of the wool reduces the tendency of the wool to fly from the cards in the form of fine waste.

In carding a stock mixture such as is used in the sample the clothing should be in good condition and the various parts set fairly close. On the

first breaker the worker should be set to the cylinder with a 26 gauge, and a 28 or 30 should be used on the second breaker and finisher. Grinding should not be resorted to at too frequent intervals, and must be very carefully done. Avoid setting the grinder on too hard, or there is great danger of forming a hook on the end of the wire which will prevent the doffer from taking the stock from the cylinder. Should this occur, it will be necessary to "face" the clothing, that is, run the cylinder in the opposite direction, grinding

Against the Points

of the wire. This should never be undertaken unless absolutely necessary, as it has a decided tendency to loosen the wire in the foundation, a condition of affairs that is extremely undesirable and may require considerable labor to remedy. To overcome this defect, it may be necessary to resort to "flocking," which, even when done by an expert, will not put the clothing in as good condition as it was originally. Excessive grinding is also very apt to cause the teeth to shell out, particularly if the clothing has been in use for a considerable length of time. When this occurs to any great extent, the only remedy, and one that is very expensive, is to replace the clothing.

If the hooking of the clothing is but slight it may be remedied sometimes by running a roll covered with old fancy wire against the points, set fairly well in. The care of carding machinery is extremely important, as on its perfect condition depends the ability of the carder to turn out roving that will spin well and

Give the Desired Results

in the finished goods. The clothing is very expensive, and may be seriously injured in a variety of ways. There are many mills in operation to-day that have no bur picker in their equipment of preparatory machinery, trusting to the bur guards in the first breaker to throw out the burs contained in the wool. This is a very shortsighted policy, as the cost of installation and operation would be more than overbalanced by the saving of needless wear and damage to the card clothing. Examples to prove this contention are probably familiar to every carder, a recent experience in Pennsylvania bringing it to mind very forcibly. The carder was about to grind the set, and had removed the top work, leaving the cylinder plainly visible from all parts of the room. Even when standing by the condenser on the finisher of the set the appearance of the cylinder was much like that of a dusty road at the beginning of a shower, it would be impossible to place the tip of a finger on it without touching a spot where the wire had been knocked down by a bur or other hard substance. The clothing was ruined, so far as the carding of fine or medium stock was concerned. Extreme caution is required in the grinding of the doffer rings also, as on their condition the quality of roving produced is largely dependent. Overgrinding is more apt to be the trouble than lack of it to keep the clothing sharp.

Make the roving slightly over half draft, keeping tops and bottoms separate. The fact that they weigh alike presupposes that they will run alike on the mule, but experience has taught most of us the wisdom of spinning separately, or on the two sides of a mule, having variable roving speeds for each side. A

Frequent Source of Trouble

in subsequent operations is the making of heavy or light side ends. These may come next to the waste ring on each doffer or on the opposite end. The trouble may be that the waste ring is taking too much stock, but more often it will be found that the cause of the trouble is at the back of the card. It may be that the Apperly is not set quite as wide as it should be, or that the traverse motion is speeded too fast, causing the roving to draw at each

side. These suggestions may assist the carder in locating the trouble, or at least give him an idea as to where it may be found.

Spinning practically perfect yarns from well-made roving is usually comparatively easy, and from our stock mixture should present no difficulty whatever. Let the mule start out at a fair rate of speed so as to begin drawing the yarn before too much twist has been inserted, otherwise there will be greater breakage of ends than should occur. Keep the faller well weighted, thus building a firm bobbin that will not slough off in spooling or weaving. Have all broken ends tied, no splicers being allowed either in warp or filling.

Spoolers should be taught to tie a knot that will not slip, and must be cautioned to leave no long ends. The dressing, from spools made practically perfect, free from

Holes and Double Ends,

should not require much time, as the reels may readily be operated at a speed of from 8 to 11 turns per minute. In beaming, the use of a compressor will be found to increase the amount of yarn that can be placed on a beam, and will aid in the making of a warp that will weave well, increasing the production per loom, as the yarn will retain its elasticity to a remarkable degree. Run the worsted filling with as little brush in the shuttle as is compatible with perfect work. Burling and sewing are almost negligible items, as the work should come from the weave room practically perfect. The fulling may be done in the grease, unless there is reason to suspect that the white will be stained. If such is the case, scour and extract, then run through the soaping machine, and full to 57 inches in width, with no endwise shrinkage. Wash out every trace of soap, extract and dry. When thoroughly dry, the pieces should be lightly sheared to remove any long hairs, have a run on the brush and be pressed. As they emerge from the press give them a light steaming and roll up. The finish will be much more permanent if they are allowed to remain overnight on the rolls.

LAYOUT.

1,944 ends; 13½ reed, 2 per dent = 72" + 1½" for listing = 73½" over all.

60 picks.

Dressed:

3 run brown	2		2
3 run slate		2	2
3 run white		2	2
			6
			54
			324
			*6
			1,944

*Sections.

Filling:

2/36 white	1		1
2/36 slate		1	1
2/36 brown		1	1
			3

STOCK MIXTURE.

50% medium wool @ 40c. = 20c.
50% shoddy @ 16c. = 8c.

16) 28c.

An ounce = 1¾c.
2/36 worsted @ 76c. per lb. = 4¾c. an oz.

CALCULATIONS.

1,944 ends, 3 run = 6.48 oz. + 10% take-up = 7.2 oz.

60 picks 2/36 = $\frac{60 \times 73\frac{1}{2}}{36 \times 560 \div 16 \div 2}$ = 7.0 oz.

Loom weight = 14.2 oz.

COST.

7.2 oz. + 20% waste = 8 oz. @ $.0175 = $ .1400
7 oz. + 3% waste = 7.22 oz. @ $.0475 = .3429

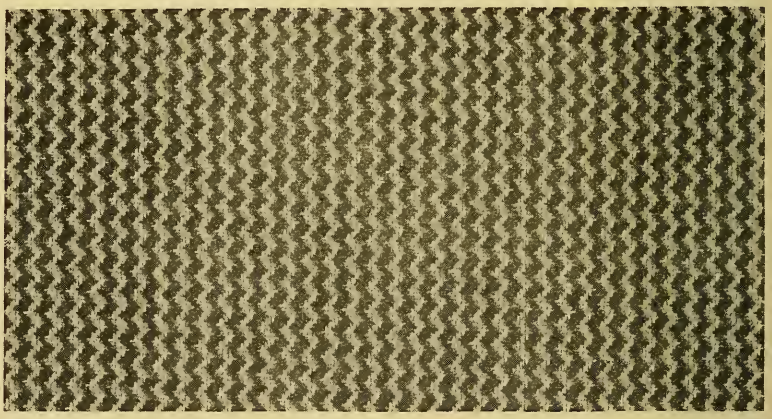
Cost of stock = $ .4829
Cost of manufacturing = .3750

Net mill cost = $ .8579

6 harness, straight draw.

NOVELTY CHECK WORSTED AND COTTON DRESS GOODS

The fabric illustrated is one that should show a good profit for a mill producing its own worsted yarns, as it can be made on the double-loom system and the worsted filling woven directly from the spinning bobbin in the single. The warp is dressed four ends of white 2-50s worsted and four ends of black 1-20s cotton, the filling pattern, four picks white 1-24s worsted and four picks black 1-20s cotton. In appearance and handle the fabric very closely approximates one made entirely from worsted, being very cleverly fabricated and intended to convey to the uninitiated the idea that it is a pure worsted cloth. It must not be understood from the foregoing statement that the manufacturer expects to merchandise the fabric for other than what it is, half cotton, for the buyer in these days is far too familiar with the construction of cloths to be deceived by such a fabric as this. The deception comes when the cloths are sold by the retailer, a lamentable lack of knowledge as to the component parts of his mer-



Novelty Check Dress Goods.

chandise being evidenced every day in our department stores. Unless we are to believe that, in addition to the exorbitant profits figured on his merchandise, the intention is to deceive the buyer, we are forced to the conclusion that the average merchant has very little knowledge of the goods he handles daily. That the latter more charitable view of the case is correct is certainly not the fault of the manufacturer, as no one would adopt the suicidal policy of attempting to sell their fabrics as other than they really are. The

Amazing Ignorance

of the ordinary salesman in our department stores concerning the fabrics handled is well-nigh beyond belief, and is absolutely without excuse in these days, when the actual facts as to the construction of fabrics are so readily available in language free from technicalities. That anyone remains in ignorance as to the methods of determining the relative amounts of wool and cotton in a given fabric, presupposes a disinclination to avail himself of the means at hand of acquiring the information, and goes far toward explaining why they never advance to positions of responsibility. The cot-

ton used may be, and in all probability is, purchased on a section beam ready for the dresser in fast black, either a sulphur or a developed black. It must be absolutely free from any tendency to crock or stain the white worsted during weaving or finishing.

The worsted is made from a clear white half-blood territory of fair staple, preferably a French spun yarn. The advantages of using French, or dry spun yarns in fabrics of this character are obvious to anyone conversant with the process of yarn manufacture. Yarns spun on the French system

Are Usually Softer

and possibly a trifle more plump than an equivalent grade and size made by the English or Bradford system, and are particularly adapted to the production of goods of this character. The softness and fullness of the worsted aids materially in relieving the harsh touch that would ordinarily result from the use of so large a proportion of cotton in the fabric. The warp yarns should be carefully inspected before the warps are dressed, as it is obvious that imperfections may be removed much more readily while the yarn is free than when woven into the goods. The importance of thorough yarn inspection is sometimes overlooked, especially if the yarns are to be woven by the spinner. This is a great mistake, as it may be easily proven that the expense of inspection is more than overcome by the increased production from dressers and looms, owing to the improved condition of the yarn. The great decrease of time and labor required for the burling is also a feature that should appeal to the manufacturer who is anxious to economize and bring his manufacturing costs to a minimum, while raising the standard of his product. Too often it is thought that these trifling details are not of sufficient importance for the manager to bother with, but efficiency reduced to its lowest terms is elimination of unnecessary work, and performing the work that is required with the greatest economy of time and labor. If we are to do this, there are no trifles in the conversion of raw materials into finished fabrics, each operation being of the utmost importance, and each operative should be taught to feel that the success of the mill is dependent, in part at least, on the proper performance of his or her duty.

Spooling should be carefully attended to, the tension on each thread as even as it is possible to secure, and the spool be free from holes. Only by having practically perfect spooling is it possible to obtain a high production in the dressing room of warps that will give the

Best Possible Results.

in the weave room. In beaming, see that the flanges are perfectly true and that the reel is in such position that the warp is delivered exactly between the flanges. The looms should be carefully gone over before the warps are hung, the stop motion examined, oiled, and if necessary, adjusted. New friction bands should be placed on the beam heads, and the take-up placed in perfect condition. Hang the harnesses uniformly, with a slight slope upward from the front, that the shade may open evenly. Tie in the warp, taking care to have the same tension on each section, and avoid making unnecessary waste. Drop the harness leveling blade and turn over the head motion. The bottom shade should clear the race plate nicely, but must not be high enough to cause the shuttle to fly out or split bobbins. Take a few picks, then level the harnesses and tie in all broken threads. After weaving the heading put in the filling, weave an inch or two and look over the harnesses. Every broken thread should be tied in, wrong draws corrected and wrong colors made right. Weave sufficient to see that the picks are correct, and the looms should be turned over to the weaver in operation. As soon as convenient after coming from the loom, the pieces

should be inspected over a perch and measured, proper records made and the goods are then ready for the burlers.

The burling room should have an equipment of tables with a perfectly smooth top, preferably of metal, so that the girls may easily find the knots as they pass their hands over the surface of the cloth. They should be instructed to raise the knots on both sides of the cloth, remove all slugs and bits of foreign matter, the tangled ends of broken threads and filling which have been drawn in at the sides. Sewing is the next operation, requiring some skill on the part of the operative to correctly replace missing threads of warp and filling. The sewers must replace hard twist ends, wrong draws, wrong colors, mend floats and small holes, putting the cloth in as nearly perfect condition as possible before scouring.

The scouring operation is usually performed in a four, six or

Eight-String Washer,

the goods passing in rope form between heavy rollers, which effectually remove the grease and dirt. The soap used should be a pure, neutral palm oil, with no trace of free caustic alkali. The scouring soap for a fabric of the type described should not require more than three ounces of soap and two ounces of alkali to the gallon of water to cleanse them thoroughly. Run in the suds with warm water for 15 to 20 minutes, open the gates and rinse all the soap and dirt out. Extract and immediately take to the dryer. Goods should not be allowed to lie around while damp, as the exposed parts are likely to dry out to a certain extent, and will not give even results in the finishing. Avoid too high a temperature in drying, as the handle of the goods will be injured by excessive heat. Give a run on the brush and shear quite closely, brush, examine, and, if necessary, take to the fine sewers. This operation should have the attention of the most expert sewers to be had, as it is a matter requiring no mean degree of skill to sew on finished goods and leave no trace. Brush, spray and press.

LAYOUT.

3,840 ends; 15 reed, 4 per dent = 64" + 1½" for listing = 65½" over all.
72 picks.
8 harness, straight draw.
Dressed:

White worsted	4	4	
Black cotton	4	4	
		8	
		60	
		480	
		*8	
		3,840	

*Sections.
Filling:

White worsted	4	4	
Black cotton	4	4	
		8	

CALCULATIONS.

1,920 ends 2/50 worsted = 2.2 oz.
+ 10% ..... = 2.43 oz.
1,920 ends 1/20 cotton = 1.82 oz.
+ 10% ..... = 2.00 oz.

36 pks. 1/24 wrstd. = $\frac{36 \times 65.5}{24 \times 560 \div 16}$ = 2.78 oz.

36 pks. 1/20 cot'n. = $\frac{36 \times 65.5}{20 \times 840 \div 16}$ = 2.24 oz.

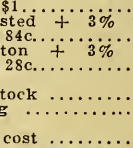
Loom weight ..... 9.45 oz.

COST.

2.43 oz. worsted + 5% waste =
2.55 oz. @ $1 ..... = $ .1593
2.78 oz. worsted + 3% waste =
2.86 oz. @ 84c ..... = .1501
4.24 oz. cotton + 3% waste =
4.42 oz. @ 28c ..... = .0782

Cost of stock ..... $ .3876
Manufacturing ..... = .3040

Net mill cost ..... $ .6916



NOVELTY CLOAKING, IMITATION CHINCHILLA

A greater interest in fabrics manufactured from novelty yarns has been manifested of late than has been in evidence for a number of years. The popularity of imitation furs, ratinés and bouclés has led to much experimenting on the part of yarn manufacturers, with a resulting increase in the number of novelties offered the weaver. The effect obtained in the sample illustrated is a high-colored background covered with a mass of closely curled loops of contrasting colors, the result being an extremely attractive fabric without the clumsy, bulky appearance that characterizes many of the offerings of rough-faced coatings. The production of novelties in any line is a source of much more profit than can be obtained in the manufacture of standard staple goods. In no line of manufacturing is this more true than in the textile field, more particularly in the department of ladies' wear. The price that may be obtained for a novelty that meets with popular approval is not based on intrinsic value or cost of production, but is entirely a question of how much the public can be induced to pay, and is largely a question of clever advertising and securing the approval of a few acknowledged leaders of fashion. When successfully introduced, production should be hastened as rapidly as possible, to secure the cream of the market before the horde of imitators are able to follow with a fabric at a lower price that approximates the appearance of the original, though usually of much less value. It would seem that a law to prevent copying fabrics and styles would be of much more benefit to the trade than much of the legislation that is proposed.

Opportunities Offered.

The opportunities offered the designer in the fabrication of cloakings of this type are not confined to weave combinations, but include the tasteful blending of colors in both warp and filling. The sample taken as a type has a woolen warp of solid red, in a medium shade, the filling being of red wool, identical in color and stock with the warp, and two shades of a novelty yarn, alternate picks of black and Bismarck brown, 6-18 spiral, the loops formed in fulling covering the face and almost entirely obscuring the warp, though the color shows through sufficiently to form a pleasing combination with the filling yarns. The warp and ground filling are made from a stock mixture of medium wool and shoddy of a light shade, or preferably a stock made from red cloth clippings. The warp yarn is spun four run right twist and the filling four and a half run left twist. The stock should be carefully mixed in the picker house and well carded. The roving should be clear and free from twits, made a trifle over half draft. In spinning, the most important feature is the production of a strong, elastic yarn, smoothness being of secondary importance, as the woolen yarns do not show to any extent on the face of the fabric. The stock used must be possessed of good felting qualities, as on this depends to a great extent the success of the finish desired. The worsted yarns used to give the loop effect on the

face are made especially with this end in view. Instead of twisting two threads of the

Same Size and Quality

together, as is the usual custom, the spiral yarn used for this fabric is made by twisting a single twenty-six, made from half-blood wool, with a single eight, made from a lustrous crossbred, or mohair. The result is a thread that, instead of being smooth as the ordinary worsted thread, has the appearance of a corkscrew. The reason for using yarns of such diverse sizes and grades is that during the fulling operation the wool and fine worsted threads are very much shortened, while the heavier, coarse-grade worsted, with relatively little capacity for fulling, instead of being shortened, forms little loops or curls on the face of the goods, covering the face completely with innumerable little curls, somewhat resembling the appearance of a chinchilla. The fabric is frequently termed imitation chinchilla on this account.

The manufacture of the novelty filling yarns is not usually undertaken by the weaver, but is a specialty with certain worsted spinners and a few concerns that buy the various worsted yarns and have only an equipment of twisters, loopers and other machinery for the production of novelties for the trade. The advantages to be derived from manufacturing such yarns by the weaver are largely overcome by the fact that there are long periods when a considerable equipment of rather expensive machinery may be idle, the

Fixed Charges Overbalancing

the saving in expense of buying novelty yarns at possibly infrequent intervals. Spiral yarns are possibly the simplest form of novelties, and may be made on the ordinary type of twister, while for the manufacture of loop yarns, picot and knots, a special twister with two sets of delivery rolls and a variety of attachments is necessary.

The warps are dressed in eight sections, using 8½ spools of 48 ends each, or 10½ spools of 40 ends each, making 420 ends per section, without the use of special spooler guides. The full draft repeats on 24 harnesses, but may be reduced to 16 without undue crowding of the threads. Burling and sewing require but little attention, as minor imperfections will not be seen in the finished goods. Fulling is the most important feature in the finishing of fabrics of this character, as on the results of this operation depend the success of the finisher. In many mills it is customary to run the goods into the fulling mills, throw in the cold soap and trust to luck to get even results. This method may work very well on goods that require heavy fulling for a long period, but would prove disastrous if tried on goods such as we are to finish. Better results are obtained if even distribution of the soap is secured by means of a soaping machine and the

Goods Are Tacked Before Fulling.

Just why tacking, or loosely sewing the edges of the pieces together before fulling, produces more even results is a question concerning which there are many opinions held by finishers. That such results are obtained is unquestionably true. One of the best reasons given is that the tacking forming the piece into an endless tube tends to confine the air within the tube, and as this is forced back by the action of the rolls, it prevents the running of the goods in the same folds during the fulling, thus preventing the formation of welts or mill wrinkles, a defect impossible to remove if once formed.

If the goods are fulled without tacking, they should be examined at intervals to see that satisfactory progress is being made, and if any tendency to welting is noticed the pieces should be stretched in width by hand before the mills are again started. The soap used on these cloths must be one that can be absolutely relied on as to purity, fulling and detergent properties, as the use of an inferior soap on a single set of pieces will cause a loss sufficient to pay for several barrels of the best soap procurable. Full to 57 inches in width, with no loss in length, removing immediately to the washer. Run for a few minutes in warm water, when, if a good soap has been used, the goods should lather up freely. Scour thoroughly and rinse well before taking from the washer. Extract and dry at a moderate heat. Shear off the long hairs and give a moderate pressing.

LAYOUT.

3 360 ends; 11 reed, 4 per dent = 75½" + 1½" for listing = 77" over all.
76 picks.
Dressed:
4 run red 420
*8
*Sections. 3,360

Filling:			
8/26 black	1		1
3/26 brown		1	1
3½ red	1		1
			3

STOCK MIXTURE FOR WARP AND WOOL FILLING.

50% wool @ 44c. = $ .22
50% shoddy @ 24c. = .12
$ .34

$.34 ÷ 16 oz. = 2⅛c. per ounce.
8/26 novelty @ 88c.

CHAIN DRAFT.
1 worsted.
1 wool.

CALCULATIONS.

3,360 ends 4 run = 8.4 oz. + 10% take-up = 9.33 oz.

$$38 \text{ picks } 4\tfrac{1}{2} \text{ run} = \frac{38 \times 77}{350} = 6.50 \text{ oz.}$$

$$38 \text{ pks. } 8/26 \text{ wstd.} = \frac{38 \times 77}{4\tfrac{1}{2} \times 560 \div 2 \div 16} = 16.78 \text{ oz.}$$

Loom weight ..... 32.61 oz.

COST.

15.38 oz. woolen + 20% waste = 19.85 oz. @ 2⅛c. = $ .4218
16.78 oz. novelty + 3% waste = 17.27 oz. @ 5½c. = .9498

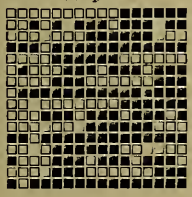
Cost of stock $1.3716
Manufacturing ..... = .4420

Net mill cost $1.8136

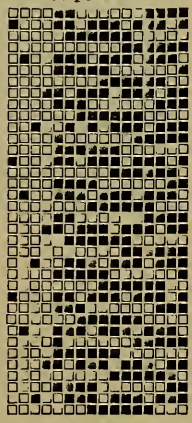
CHAIN DRAFT.

Worsted	1	1	2
Wool	1		1
			3

76 picks.



56 picks

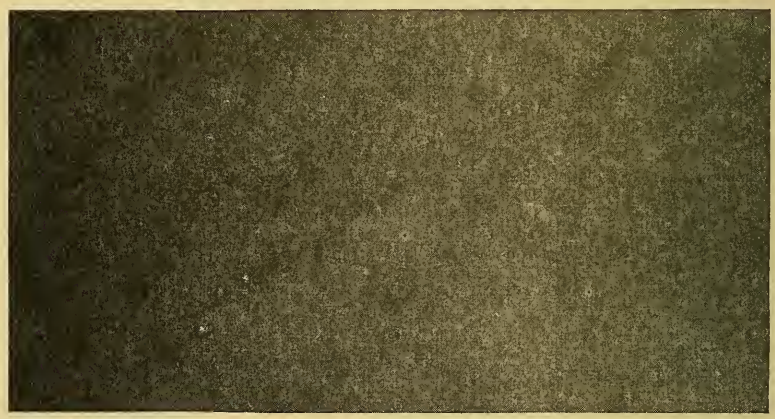


PIECE-DYED BROCADED DRESS GOODS

That style changes run in fairly recognized cycles is a statement often made, and one that may be readily proven by an examination of the style books of former years now packed away in some dusty corner of the mill attic. Each special type of fabric has its run of popularity and is then relegated to a place in the rear of the procession or is entirely neglected for a time, only to be revived, possibly under a new name, and exploited as the "dernier cri." As an example of the return to popular favor of a fabric which has led the market twice within the memory of many of our present-day manufacturers the bouclé may be cited. Twenty years ago thousands of pieces were turned out by the Beoli Mill, then owned by James Phillips, Jr., many of the styles being copyrighted. Other manufacturers were quick to see the possibilities of large profits in the production of a fabric which apparently could not be turned out in sufficient quantities to supply the demand.

Demand Quickly Changes.

The fickleness of the cloaking trade was proverbial even at that time, and the demand was a thing of the past almost overnight, to be revived in all its former vigor twenty years later. A similar story might well be told of brocaded dress goods, which have been in their heyday of prosperity of



Piece-Dyed Brocaded Dress Goods.

late. Jacquards, which have not been in use for years in many of our mills, have been overhauled and again placed in commission, while designers in mills with no jacquard equipment have racked their brains to produce similar effects on the ordinary harness loom. The result has been an unlimited array of figured cloths in a range of colorings that seems well-nigh endless. Some of the most popular effects have been produced in solid colors, the decoration consisting of floats of a heavy filling in a variety of figures,

produced by lowering certain of the warp threads in a predetermined order.

The fabric illustrated is the product of a domestic mill, and compares very favorably with similar fabrics from abroad, both in fabrication and finish, and is of greater intrinsic value than foreign cloths of the same price. The yarns from which the goods are made were spun from South American crossbreds on the Bradford system, and are such as are quoted in the columns of the American Wool and Cotton Reporter from week to week. The warp in the fabric analyzed is a two-ply thirty-two, but it is not essential that a two-ply yarn be used. The advantages to be derived from using twofold yarn are

Greater Strength in Weaving,

less danger of breakage from the loose fibres intertwining, and a smoother fabric. The comparative looseness of the filling figure prevents shearing very closely, as there would be imminent risk of cutting the filling were this attempted. In many of the styles shown the figures are developed in part, or entirely, by special warp threads, or by the introduction of threads of entirely different material. The fabric under discussion, however, depends entirely upon the weave and texture for its ornamentation. The texture of the fabric is comparatively low, counting only 40 warp ends and 36 picks per inch. The warp and fillings are interlaced with a plain or cotton weave, except at the points where the heavier two-ply filling is floated over the warp ends to form the figure.

It will be readily understood that a much wider range of patterns may be produced with a jacquard head than are possible for the designer who has at most but thirty or thirty-six harnesses at his disposal. It is in the latter case that greater technical skill is demanded, and a surprisingly large variety of styles may be developed by the designer whose training has been thorough along these lines. The larger part of the fabrics of this character are produced by mills who specialize on dress goods, and in most instances spin their own yarns, as they are thereby enabled to figure closer than the mill that depends on independent spinners for the yarns required. The wools are sorted carefully, the coarser and finer grades thrown into suitable receptacles to be later used in the manufacture of yarns for other fabrics, and the particular grade desired for the production of the fabric in process is sent to the scouring room. The ancient and honorable method of wool scouring, so familiar to the older generation of mill men, has in these days been almost entirely superseded by the

Mechanical Wool Washer,

a machine which will permit of two men thoroughly scouring 10,000 to 12,000 pounds of wool daily. The clean wool is then dried and sent to the card room, where it is put through a worsted card, usually of three cylinders, from which it comes in the form of a continuous sliver and is rolled on a spindle by the balling head. After passing through the preparing gill boxes, the slubbing is put on the "punch box" and rolled into balls of four ends each, suitable for the comb.

The combing process removes all the short fibres, seeds, shive and other

foreign matter, leaving only the long, comparatively straight fibres to be drawn off in the form of "top." A peculiar feature of the Noble comb (the type generally used in the Bradford system) is that the fibres taken from the large circle and those from the small ones

Point in Opposite Directions,

and the longer fibres for the most part lie on one side of the sliver. The gilling operations tend to correct the latter feature, and distribute the long and short fibres evenly throughout the finished top. The required size is obtained by a system of doubling and drawing explained in detail in a former article. The finished yarn for the warp is placed on jack spools, for convenience in handling, and the warps dressed without sizing. The production per loom should show a high average, as the warps are strong, and the texture such that the yarns are not unduly strained in weaving. Burling and sewing are performed in the customary manner, and the pieces sent to the washers. It is essential that fabrics intended for piece dyeing should be

Thoroughly Free from Soap,

or the coloring will be attended with considerable difficulty and uneven shacks will result. When clean, the pieces should be crabbed, an operation requiring great care, as improper treatment in this process will greatly influence the success of the dyeing. In coloring, the usual procedure is to run eight, ten or twelve pieces into the dye-kettle, throw the ends over the reel, sewing the ends of each piece together, forming an endless band of cloth, so that during the dyeing the pieces are constantly changing position, each section of the cloth being part of the time in the dye-bath and part of the time exposed in its passage over the reel. When the desired color has been obtained, draw off the kettle, cool and rinse the pieces, extract and dry at a moderate temperature.

When dry, brush and shear, or singe to remove the long hairs, as the finished goods should be as clear as the nature of the pattern will permit. Brush and inspect, then if necessary take to the fine sewers, where imperfections hitherto neglected may be repaired. The goods are now ready for the press, and should be run through with moderate pressure, the steam registering 60 to 70 pounds. A final inspection and the goods are ready to be rolled up for casing.

LAYOUT.

2,240 ends; 17½ reed, 2 per dent = 64" + 1½" for listing = 65.5" over all.

36 picks.

Warp:
White 2/32 ¼ blood.

Filling:

White 2/20 ¼ blood	1		1
White 1/20 ¼ blood		1	1
			2

CALCULATIONS.

2,240 ends 2/32 = 4 oz. + 10% take-up = 4.44 oz.

18 picks 2/20 = $\frac{18 \times 65.5}{20 \times 560 \div 2 \div 16}$ = 3.37 oz.

18 picks 1/20 = $\frac{18 \times 65.5}{20 \times 560 \div 16}$ = 1.68 oz.

9.49 oz.

4.44 oz. + 7½% waste = 4.80 oz.
3.37 oz. + 5% waste = 3.55 oz.
1.68 oz. + 5% waste = 1.73 oz.

COST.

4.8 oz. @ 70c. per lb.	$ .210
3.55 oz. @ 64c. per lb.	.142
1.73 oz. @ 60c. per lb.	.065
Cost of stock	$ .417
Manufacturing, 36 picks	.218
Net mill cost	$ .635

WORSTED DIAGONAL DRESS GOODS

The remark is frequently heard, that woolen goods are made in the finishing room. While this is true to a certain extent of all types of woolens, it especially applies to the large variety of fabrics with a close, smooth finish, generally known as "face goods." The reverse is the case with most of the worsteds, both men's wear and dress goods, they must be "made in the loom" very largely, as they do not undergo such a radical change of appearance during the process of finishing. It must not be inferred that

Worsted Finishing

is an extremely simple process, or one that does not require the services of a skillful overseer, as lack of care and attention in this department often means making "seconds" out of pieces that with correct handling would have been perfect. The weaving of these goods must be well done in order to avoid an excessive amount of sewing and mending. There are two very great advantages in using worsted for the manufacture of dress fabrics. First, it is possible to obtain clearer designs with sharp outlines and clear cut patterns, and also to produce a fabric that will be serviceable at a much lighter weight than those made from woolen yarns.

The finer qualities of diagonals are made of fine high-grade wools spun to high counts and used twofold for warp, while the filling is spun from the same grade of stock, but in coarser counts and is used single. The lower priced fabrics are made from coarser stock and usually single yarns for both warp and weft. Single yarns are not nearly as smooth as the two-ply and require very careful handling in the dressing and weaving departments, if good results are to be obtained.

To Prevent Undue Chafing

of the threads during the weaving, the warps have a thorough application of a fairly heavy and well penetrating size in the dresser. It is not well to use too few harnesses, as the consequent crowding of the heddles will cause the threads to break from excessive chafing, causing less production and greater expense in the sewing room. The reed must be fine enough to beat the pick home firmly without cutting the filling or giving the cloth a striped appearance, due to using a reed so coarse as to allow the warp threads to become too much separated with an empty space in front of each wire. After weaving, the goods should be carefully inspected and all damages marked with chalk so that the menders may be able to spend their whole time in repairing imperfections, instead of wasting valuable hours in looking for places that need their attention.

After Burling and Sewing

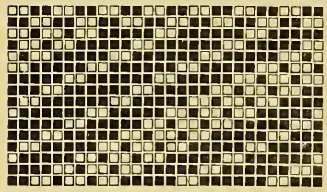
the goods are scoured with a light neutral soap, carefully rinsed, extracted and sent to the crabbing machine. For goods of this character there is nothing more satisfactory than a continuous crabbing machine, which takes the goods at one end, gives them a thorough treatment and delivers them at the other on rolls. Better results are obtained if the goods are allowed to remain on the rolls over night, and should be turned end for end at least once to avoid having the water settle at one side of the piece. If the pieces are thoroughly cleaned and free from soap, the dyer should have no difficulty in bringing the pieces out even. The tub must not be crowded and it is important that the steam pipes be so arranged that the water is heated evenly all over the tub. After a thorough rinsing the goods

are dried in the usual manner and are given a run on the sanding machine to raise the loose fibres

Previous to Shearing.

The shear must be in good condition, as it is necessary to clean the face of the goods from all nap and loose fibre. When this is done properly, every thread stands out clear and distinct so that the beauty of the texture and design is brought out to its fullest extent. Because of the clear finish which is required on goods of this type, it is impossible to so manipulate them in finishing as to cover up defects in the manufacture. Every thread must be in its place showing up clear and round, or the effect which the designer has tried to bring out is marred. The goods should again be inspected, imperfections mended that have escaped hitherto, and after a run on the brush they are ready for pressing.

FRONT.



Layout:
Warp, 3,840 ends 1/24; reed 15/2—4=62½" + 1½" for listing = 64" over all.
Filling, 90 picks 1/32.
Finished width 52".
Finished weight 9 oz.

CALCULATIONS.

3,840 ends 1/24 = 4.57 oz. + 5% take-up .....= 4.79 oz.

90 picks $\frac{64 \times 90}{32 \times 560 \div 16}$ .....= 5.10 oz.

Loom weight ..... 9.89 oz.

5% waste ..... .49 oz.

10.38 oz.

COST.

10.38 oz. @ 68c. per lb.....= $ .441
Manufacturing, 90 picks.....= .425

Mill cost ..... $ .866

WORSTED CHEVIOT CLOAKINGS

Cheviots for ladies' coatings are usually coarse, rough appearing fabrics with warp and filling of contrasting colors or with a more or less pronounced pattern. They derive their name from the resemblance to the fabrics which were originally made from wool sheared from the sheep raised on the Cheviot Hills, which was rather coarse and curly. The desired effect can be obtained by a selection of yarns not too low in grade and proper treatment in process of manufacture. The ideal cheviot is neither sleazy nor tight, has a fairly thick, curly nap with sufficient felt to retain its position without becoming rough and shaggy, but not so heavy as to obscure the pattern too much.

The Selections of Wool.

A very satisfactory yarn for this class of fabrics is combed from Missouri quarter-bloods, which give bright, snappy colors and a very good handle in the finished cloth. To obtain the finish peculiar to this class of goods, it is necessary that they be woven sufficiently wide to allow for fulling in width. If woven narrow enough to come to the proper width in scouring, the nap will not be sufficient to finish up as desired. The best results are acquired by laying the warp from four to six inches wider in the reed than for clear finished fabrics. The burling and mending are done in the usual manner, and the pieces are then run into the fulling mill. None but the best materials should be used in fulling. Soap should be free from impurities of all kinds, especially should the presence of free caustic alkali be guarded against. It is very readily detected by a simple test. A drop of phenol phthalein placed on the soap will betray it at once

by the pink color developed. The wool fibre can be dissolved entirely by a solution of harsh alkali and a weaker solution has a tendency

To Injure the Fibre,

rendering it brittle and giving the goods a harsh "unkindly" touch. A pure palm oil soap, absolutely neutral, is the best to use on this class of goods. After fulling to width, the pieces are run into the washer with lukewarm water and washed for twenty to thirty minutes, the dirty suds washed out and then given a good rinsing in cold water. If there is any doubt as to their being clean they should have another washing with one pail of soap to each piece, followed by a thorough rinsing that will remove every trace of soap. Five minutes in the extractor should be sufficient to prepare the goods for the dryer. Drying in the open air is very much to be preferred if practicable, as the goods will handle much better. If necessary to dry artificially, do not hurry the process, as excessive heat, particularly in combination with moisture, has a very injurious effect. The shearing of these goods consists merely of cropping off the longer fibres that the finished goods may not have a shaggy appearance, but a nap of even length throughout. A light steaming after pressing is beneficial.

Layout:
1,920 reed 14—2 = 68½" + 1½" for listing = 70" over all.
Warp, 1,920 ends 2/15 purple = 7.31 oz. + 10% take-up.....= 8.04 oz.
Filling, 28 picks 2/15 black = 28 × 70
7½ × 560 ÷ 16 .....= 7.46 oz.
Loom weight .....= 15.50 oz.

COST.

15.50 oz. + 5% waste = 16.27 oz. @ 68c. per lb. .....=	$ .691
Manufacturing cost .....=	.285
Net cost	$ .976

Six harness, straight draw.

WHIPCORDS

Fabrics known as whipcords are steep twill diagonals in which the warp is floated over several picks of filling in such a manner as to throw it on the surface in a decided roll. The finished goods have the appearance of well twisted cords laid diagonally on a plain surface. To get good results in fabrics of this nature the warp should be dressed of two-ply yarns. The filling may be, and invariably is, used single in dress goods of this weave. These cloths are not difficult to produce, as the warp, being of two-ply yarns, is smooth and strong, the weave not hard on the thread, nor are they apt to give trouble in the finishing room. The

Major Part of the Dress Goods

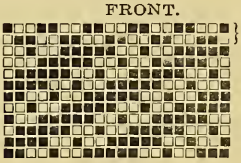
in this fabric is made of quarter-blood yarns and has a rather harsh touch. The dressing may be done on a dry frame, that is, one that has no sizing attachments, as there will be no danger of chafing in the loom, with threads broken from that cause. In the finishing room this class of goods will be found to require comparatively little mending and ordinary care should give excellent results. The burling should be carefully attended to, all the knots raised, slugs, etc., removed. After mending, the goods are scoured, dried and

Taken to the Polisher.

This machine has two rolls covered with sandpaper and two filled with bristles. By means of suitable guide rolls the cloth is given more or less contact with each roll twice while passing through. Ordinarily one run will loosen up the loose fibres sufficiently for the raising brush on the

shear to lift them into such a position that they will be cleaned off nicely by the revolving blade. After shearing, a run on the steam brush will put the goods in good condition for the press. Run through the press with the face to the cylinder, rolling them as they come off, and allow them to cool off on the roll before inspecting.

FRONT.



Layout:
3,840 ends 2/36s ⅜ blood.
60 picks 1/24s ¼ blood.
3,840 ends reed 15—4 = 64" + 1½" for listing = 65½" over all.
Finished width 52".
Finished weight 10 oz.

CALCULATIONS.

3,840 ends 2/36s = 6.09 oz. + 5% take-up ..... = 6.39 oz

60 picks $\frac{60 \times 65\frac{1}{2}}{24 \times 560 \div 16}$ ..... = 4.68 oz.

Loom weight ..... = 11.07 oz.
5% waste ..... = .55 oz.
11.62 oz.

COST.

6.39 oz. + 5% waste = 6.7 oz. @ 80c. per lb. ..... = $ .335
4.68 oz. + 5% waste = 4.9 oz. @ 68c. per lb. ..... .207
$ .542
Manufacturing, 60 picks..... = .300
Net cost ..... $ .842

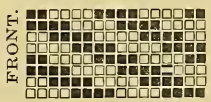
WORSTED CHEVIOT MEN'S WEAR

A particularly good example of worsted cheviot for men's wear has a somewhat different construction than the ordinary type. Instead of using a yarn spun to low counts for the warp, two threads of a finer number are drawn on one shaft. The filling is woven one pick in a shade, the size used being the same as that for the warp. This arrangement, apparently, would produce a badly balanced fabric, but this is not the result in the fabric here described. The resultant cloth is particularly kindly in handle and has the flat indistinct twill especially sought for in this type of goods. This type of construction

Prevents the Harshness

that would result from the use of lower count threads and gives a cloth that plump to the touch without being bulky and a fabric that is a pleasure to tailor, keeping its shape to a remarkable degree. The yarns are not twisted quite as hard as for clear finished goods, having two turns to the inch less than regular twist for this size.

16 Harness Straight Draw.



Layout:
Warp, 4,480 ends 2/24 mixture.
Reed, 16¼ ×4 = 69" + 1½" lor listing = 70½" over all.
Filling, 38 picks 2/24 mixture.

CALCULATIONS.

4,480 ends 2/24s = 10.66 oz. + 10% take-up ..... = 11.72 oz.

38 picks $\frac{38 \times 70.5}{24 \times 560 \div 16 \div 2}$ ..... = 6.61 oz.

Loom weight ..... 18.33 oz.

COST.

18.33 oz. + 7% waste = 19.6 oz. @ 82c. per lb. ..... = $1.004
Manufacturing cost ..... = .3496
$1.3536
5% loss in length..... = .0677
Cost to mill ..... = $1.4213
Finished weight 17-17½ oz.

NOVELTY CHEVIOT

Among the many cheviots offered by the manufacturers this season we have selected for analysis two which present some novel features in their construction. The special feature to which attention is called in the first example is the ingenious use of a double and twist thread in combination with a mock twist and a knot yarn to give character and life to a style which would be flat and lifeless without these aids. The stock used in both these is a combination of low-grade wool and shoddy, with a single worsted to produce the knot effect. Every thread necessary to produce these goods can be made in the ordinary fancy cassimere mill, aside from the worsted for the knot. Contrary to the usual custom of using a cotton or worsted thread for the core yarn of the novelty thread, the manufacturer has twisted the knotting thread on a woolen yarn of his own making, thus obviating the tiresome, and at times expensive, delays incident to the purchase of such threads. The machinery needed for the making of the knot yarn is not intricate, nor difficult to operate. It can be readily attached to nearly all of the modern types of twisters for woolen and worsted mills. It

Differs from the Twisters in General Use

for making ordinary ply yarns in having a set of rolls for each thread, which may be operated at various speeds as the requirements of the case may demand. In addition, there is a rod, held in suitable bearings, attached to the underside of the top frame, which is actuated by connectors to a push rod, which in turn receives its motion from a cam driven by a belt from a pulley on an extension of one of the roller shafts. Projecting from the rod are pins equal in number to the spindles of the twister, and when at rest are at a slight angle above the horizontal beside the thread in its course from the guide wire to the traveler. The revolution of the cam gives a reciprocating vertical motion to the pins, which, in their downward travel, is very nearly equal in speed to that of the core yarn. The thread forming the knot is delivered at a speed greater than that of the core yarn passing on the opposite side of the pin. In operation, the resulting effect is to twist the knot yarn around the core, forming a lump or knot during the downward travel of the pin, while the return of the pin at a much greater speed gives but few turns of the knot around the core. By a change of the cams the knots can be placed at varying intervals, and the size of the knot governed to a certain extent by the speed of the delivery rolls carrying the knot thread. It may be necessary to use various sizes of yarns to produce the correct size of knot for fabrics of different weights and textures. This is a matter that will largely depend on experience and the effect which the designer intends to produce. The two-ply thread is made on an ordinary twister, or can be made on a mule if found desirable. The

Mock Twist

requires the use of a balling head on the second breaker and a creel for the back of the finisher card. The colors it is desired to blend in the mock twist are put through the first and second breakers as separate lots and made into balls. On the finisher, the balls are put into the creel in such a manner that ends of alternate colors are drawn through the comb. In operation, it will require some care to have the comb register exactly with the rings of the doffer, so as to deliver as nearly as possible equal amounts of the two colors to each ring. The object to be obtained is a web on the ring that shall be black on one side and a complementary color on the other, so that the roving when spun will form a thread having a very close approach in appearance to a double and

twist of contrasting colors. The successful production of these mock twists will test the skill of the carder to quite an extent, but the results which it is possible to secure are well worth striving for. It is only by the use of processes which are not possibilities for the poor workman that a superior man is able to demonstrate his ability. In the time of extremely acute competition, there is still a practically unlimited field for the mill with new ideas and novel effects, which has an organization competent to put them on the market, with a certainty of being able to reproduce exactly in the merchandise delivered the identical duplicate of the selling samples. In order to accomplish this, it will be

Necessary to Keep Exact Records

of details in every department. There is too great a tendency for overseers to trust to memory as to just the treatment given the various fabrics at certain stages; departures from the usual routine are at times forgotten, with the result that the finished fabric differs somewhat from the reference sample. The weave employed is the plain or cotton one, and the warp is drawn straight on four harnesses. The yarns are coarse and should produce rapidly, the size of the threads and the weave used combining to make a firm fabric in spite of the low texture.

Layout:
1,064 ends; reed 8—2 = 66½" + 1½" for listing = 68" over all.
20 picks.
Finished width 54".
Finished weight 17½ oz.

Dressed:
1 black and grey mock twist.
1 black and purple knot.
—
2 ends.

Woven:
1 dark blue 3⅛ run double and twist.
1 black and purple knot.
—
2 picks.

CALCULATIONS

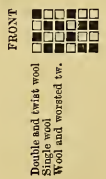
532 ends 1½ run = 3.55 oz. + 10% take-up =	3.90 oz.
532 ends 1½ and 2/36 knot = 5.19 oz. + 10% take-up =	5.71 oz.
10 picks 3 run, double and twist.. =	4.53 oz.
10 picks 1½ and 2/36 knot..... =	6.69 oz.
Loom weight	20.83 oz.

COST.

60% wool @ 40c. per lb. = 12.75 oz. @ 2½c. =	$ .319
40% shoddy @ 16c. per lb. = 7.09 oz. @ 1c. =	.071
3.8 oz. worsted + .03% shrinkage = 3.92 oz. @ 5⅞c. =	.228
Cost of stock	$ .618
Manufacturing	.220
Extra for twist	.100
Mill cost	$ .938

A very neat style can be made on the same warp by a change in the fillings used. The knot in the filling should be of orange worsted and the two-ply wool black instead of dark blue.

Another novelty which should prove popular is made without the knot yarn, using a plain wool and worsted twist about three turns to the inch for the effect thread. The arrangement of the warp threads is somewhat unusual, the dressing being as follows: One double and twist wool mixture, one single wool, one black wool and red worsted twist, the latter two threads working together.



The filling on this style is entirely of double and twist wool. The mixtures in the sample are 5 per cent white, 95 per cent black, both warp and filling, the effect produced being a plain grey surface picked out with fine spots of red. From the description it might be thought that the effect would be raw and glaring, but the reverse is the case. The style shows a very pleasing appearance, and in the tailored garment is extremely neat. The tightness of the weave in these cloths makes it necessary to reed these somewhat narrower in the loom than ordinary cheviots or cassimeres, as they do not require long fulling to obtain the desired effect. If the yarns are well carded and spun, there should be a large production from the loom with a correspondingly low overhead charge for manufacturing.

NIGGERHEADS

The fabrics known as "Niggerheads" this season are very different from the cloths familiarly known by that name some twenty years ago. We have selected for the purpose of analysis and description one of the novelties which is being marketed very freely the present season. In common with many of the various new styles shown this fall, it is especially adapted for use in ladies' coats, although in a slightly amended construction in heavier weights would prove a very suitable cloth for overcoatings. There are unusual opportunities afforded for the skillful manufacturer to copy cloths of this sort in cheaper fabrics, and a careful manipulation of the stock will give very satisfactory results at a very low cost. To the ordinary buyer there would appear to be practically no difference in garments made from either fabric. By close watch of the markets and good judgment as to style value, many of the smaller mills are able to operate continuously on these novelty cloths, and incidentally earn very handsome profits. Given the

Style and Colorings,

the intrinsic value of the goods is a minor consideration, as the demand is for "something new" each season. To obtain the best results in this cloth, there should be an intelligent selection of the wools used for the fillings, the warp yarns being of relatively minor importance, as the cloth is essentially a "filling face" fabric. The effect which is to be produced requires a lustrous, long-staple wool, spun to low counts, which will form loops on the face of the goods. These yarns are usually made from wools such as the Lincoln lusters, New Zealand crossbreds or some of the bright, lustrous South Americans. The dressing and weaving of these cloths are attended with no unusual difficulties, and the dry finishing before fulling is unusually easy. A thread out is of no great consequence although carelessness in this respect should not be allowed, as the weavers are very prone to become lax and indifferent when fabrics requiring care are in the looms. Before fulling the goods should be "tacked," that is the edges sewn together with the face inside, as experience has shown that more even fulling can be obtained in this way. It will be necessary to use great

Care in Soaping

the pieces, so that they may have an even application of soap on all parts. A soaping machine will give much better results than the old-fashioned system of throwing the soap into the bottom of the mill to be wiped up by the cloth, or of filling the soap boxes at the back and allowing the soap to work in by degrees. Probably the greatest difficulty encountered by finishers in the production of goods of this type is the tendency to form mill wrinkles or to full unevenly. The pieces should be examined occasionally during fulling, and if any tendency in this direction is noted, it can usually

be overcome by taking the goods out and shaking them thoroughly or stretching them well in the width. Do not full to the finished width, as the washing and subsequent finishing operations all have a tendency to make the goods narrower. For the particular cloth under discussion, it would be well to allow at least two inches for future shrinkage. During the washing the goods will usually be found to full up to nearly the desired finished width, and should be tentered on the dryer to measure an inch and a half over the width required. One run on the shear to crop off the long, loose fibres is all that will be found necessary. These goods may be pressed face to the bed at a moderate pressure, to add to the luster, which is one of the chief features of goods of this character.

Layout:
2,520 ends; reed 12—3 = 70" + 1½" for listing = 71½" over all.
32 picks.

CALCULATIONS.

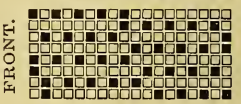
2,520 ends 2/24s = 5.5 oz. + 10% take-up ..... = 6.05 oz.

32 picks 1/6s $\frac{32 \times 71.5}{6 \times 560 \div 16}$ .... = 10.90 oz.

Loom weight ..... 16.95 oz.

Finished weight 15 oz.
Finished width 54".

18 harness, straight draw.



COST.

6.05 oz. + 5% waste = 6.35 oz. @ 90c. per lb. ..... =	$ .3570
10.9 oz. + 5% waste = 11.15 oz. @ 80c. per lb.....	.5575
	$ .9125
Manufacturing	.3136
Mill cost	$1.2261

There are many methods which may be employed to produce a fabric which in appearance would approximate the foregoing example. The yarns used in the illustration are of better grade than would be required for a low-priced fabric. We have used for fillings a first-class Lincoln luster stock, while for a cheaper cloth it is customary to employ yarns spun from the cheaper grades, even the common and braid finding an outlet in fabrics similar to this, but lacking the handle and luster. For the warp, a cotton thread may be used, which can be either purchased in the open market or made in the mill, a "wool spun" cotton, as it is usually termed. Fabrics constructed in this manner are not as satisfactory as are those made with a warp the chief constituent of which is wool. This need not be new wool entirely, but a combination of wool and shoddy or cotton. As previously stated, it is not intrinsic value alone which determines the selling price of novelties but the combination of color, design and originality of the style, created in answer to the ever-present desire for "something new and different."

FANCY WORSTED SUITINGS FOR MEN'S WEAR

The manufacture of fancy worsteds is a branch of the woolen business that is of comparatively recent growth. There are many men engaged in active business life to-day who can easily recall the time when there were few, if any, mills in this country producing goods of this description. The increase in the production of goods from combed yarns has been extremely rapid within the past twenty-five years, and at the present time a very large proportion of the light-weight fabrics sold are worsteds. There are several very good reasons for the greater popularity of worsted goods, one of the strongest being the fact that goods, both for summer wear and cold weather, have become lighter in weight. Scarcely twenty years ago, the regular weight for winter goods was twenty ounces and the spring fabrics weighed

sixteen to seventeen ounces per yard. The present spring season finds us with nine to ten ounce worsteds with wool goods ten to eleven. The accepted weight for fall goods to-day is sixteen ounces, with many mills showing fabrics for fall that weigh but little over fourteen ounces.

It is largely owing to the fact that in extremely light goods, such as the trade demands at present, worsteds offer a more sightly and better handling cloth than carded woolens, that worsted manufacturers are in much better position than their competitors who make carded goods entirely.

Another Feature

that appeals very strongly to many clothing buyers is the clean-cut, snappy styles that are brought out every season by many of our worsted mills. The making of fancy men's wear from combed yarns is a business requiring no little skill and experience. To attain success in this branch of the business requires an equipment that is modern and skilled help in all departments of the mill. We do not intend to go into the details of yarn making, as that is a business of itself, but simply to follow the process from yarn to cloth, as is the custom in most of the mills engaged in cloth making. The size most extensively used for light-weight goods is 2-40s in a fairly good quality. For the clothing trade, the half-blood is the grade in probably the greatest demand. Yarns are bought in skeins, and are usually dyed in machines, an ordinary type in common use holding two hundred and fifty pounds. During the dyeing operation the skeins are held in position by two sticks, which keep the yarn from tangling and move it through the dye liquor. After dyeing, the yarn should be well rinsed and extracted before going to the dryer. Better results are obtained if the yarn is dried by the

Cold Air Process.

This is accomplished by placing the yarn on wooden bars, which keep the skeins stretched during the operation. The bars are placed in sockets of a pair of "spiders" mounted on a shaft, the quantity of yarn so disposed as to balance the machine and the whole rotated rapidly by means of a pulley and belt from the line shaft. Yarns dried in this manner will wind with less waste and give a better handle to the finished goods than the same grade dried by means of artificial heat. When thoroughly dry the skeins are ready for winding. There are several types of machines built for this purpose, differing but slightly, and all accomplishing the desired result in a somewhat similar manner. The skeins are well stretched to separate the threads and mounted on a "swift" or "racers," as the case may be, the operator finds the free end and places it in position to go on a six-inch spool, which is rotated by a drum or other suitable mechanism. From the six-inch spools the yarn is put on dresser spools for the warp, or in some instances, is wound directly to bobbins for filling. The dressing is, in the majority of cases, done on a dry frame, the exception being very fine or tender yarn. The operation requires a skilled hand and unremitting vigilance, as irremediable damage may result from lack of care in the dressing department. The weaving of fancy worsteds also

Requires a High Class of Help,

as the work is more difficult and complex than that of a mill making staples or fancy cassimeres. This is due in a large measure to the fine counts of yarn used, and the greater variety of colors, as well as the intricate crossdraws that are necessary on certain of the styles developed. After weaving, the pieces are measured and inspected carefully over a perch, every imperfection marked for mending, the length, price number, weaver's name and other necessary data entered on the records. Burling is the next operation, usually performed by two girls seated at a sloping

table with a smooth top, which enables them to find the knots more easily. Every knot must be raised on both sides of the goods, and slugs and bits of foreign matter of various kinds removed at this time. Threads out, broken picks, holes and damages of a like nature are repaired by the sewers. Some of these become so exceedingly skillful with the needle that should a piece be cut out from the cloth they are able to insert another to replace it, performing the operation so neatly that it is impossible to discover the location of the repair. The goods are now ready for the washer, a machine consisting of a box-like bottom part to hold the scouring liquor, with suitable gates at each end so that the dirty liquor may be drawn off. In the upper part are two heavy wooden rolls, between which the cloth passes under heavy pressure, the soapy water and dirt being squeezed out and falling into a trough under the bottom roll, which carries it to an outlet on the side connecting with the sewer. The soap used for scouring fancy worsteds should be free from impurities of all kinds, and should not contain an excess of moisture. The testing of soap is so exceedingly simple that there is no excuse for a manufacturer accepting an inferior article. The most

Common Adulterants,

probably, are China clay and sodium silicate, or possibly resin. The test for moisture requires no apparatus aside from the grain scales usually to be found in the office or designing department. A small quantity of soap should be shaved into thin slices, carefully weighed, thoroughly dried and again weighed, the variation in weight showing the amount of moisture present. A mistaken idea is very prevalent, even among mill men who should be better informed, that hard soap contains less moisture than soft or crown soaps, but in many cases the reverse is true. The difference is in the composition, the hard soaps having soda as a base, while the soft soaps are formed with potash in combination with fatty acids. The test for earthy and heavy adulterants is also very simple. A small quantity of soap is dissolved in water and a little sulphuric acid added to the solution. The structure of the soap is broken up, the heavy adulterants fall to the bottom of the glass, the grease and resin floating on the surface. There is also danger of the presence of

Free Caustic Alkali

unless precautions have been taken in the manufacture of the soap. This should be especially guarded against, as it has an extremely deleterious effect upon the wool fibre, injuring its physical structure and detracting materially from the handle of the fabric. The goods should be run from twenty to thirty minutes in lukewarm water with sufficient soap to raise the dirt and oil freely, the quantity of soap to be used varying with the length and weight of the pieces. The gates should be opened and the dirty liquor thoroughly washed out, allowing the pieces to run with cold water flowing into the washer until every trace of soap is removed. After extracting, the goods are dried in the ordinary manner, usually on a "chain dryer," which holds them to the desired width during the process of drying. Before shearing, they should be "back burled," to make sure that all knots have been properly raised, then given a few runs on the polisher, which raises the nap and loose ends in good condition for shearing. In order to obtain the clear finish that is one of the prime requisites of a fancy worsted it is very essential that the shear should be in

Perfect Condition.

To bring out the beauty of design and rich coloring to its fullest effect, the shear must remove every vestige of nap or loose fibre, leaving the thread full and round, with the pattern clear and distinct. From the shear

the goods are taken to the "fine sewers," who repair any damages not discovered and rectified previously. This is a task requiring the utmost skill and patience, particularly on the finer grades of goods. Before pressing, the pieces are steam brushed and given a run on the dewing machine, the latter operation making them hold the finish much better. More satisfactory results will be obtained if the goods are rolled as they come from the press, and allowed to become cold in the roll before the final inspection. The popular fabrics to-day, for both spring and fall wear, are single or through and through cloths instead of the double ones that were in vogue only a few years ago. With this construction there is no opportunity for padding with inferior stock to obtain the extra weight in fall goods. We give below full particulars for cloths constructed on both single and double cloth systems.

Layout for 16-oz. double cloth:
Warp, 7,200 ends; reed 13½—8 = 66.6" + 1½" for listing = 68" over all.
Filling:
64 picks.

CALCULATIONS.

7,200 ends 2/40s = 10.28 oz. + 7% take-up .....= 10.98 oz.

64 picks $\frac{64 \times 68}{40 \times 560 \div 2 \div 16}$ .....= 6.21 oz.

Loom weight ..... 17.19 oz.

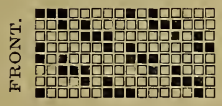
COST.

17.19 oz. + 7% waste = 18.38 oz.
@ 90c. per lb. .....= $1.034
Manufacturing .....= .435

Net cost $1.469

Sixteen harness straight draw.

WEAVE.



Layout for 16-oz. single cloth:
3,360 ends; reed 12½—4 = 67.2" + 1½" for listing = 68.7" over all.
54 picks.

CALCULATIONS.

3,360 ends 2/24s = 8 oz. + 10% take-up .....= 8.80 oz.

54 picks $\frac{54 \times 68.7}{24 \times 560 \div 2 \div 16}$ .....= 8.80 oz.

Loom weight ..... 17.60 oz.
Plus 5% waste .....= .88 oz.

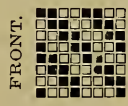
Yarn required .....18.48 oz.

18.48 oz. @ 75c. per lb.....= $ .865
Manufacturing .....= .410

Net cost $1.275

Eight harness. straight draw.

WEAVE.



VELOURS

There is a considerable diversity of opinion as to the precise cloth designated by the term velour. Some of our manufacturers would class as velours any cloth having a soft, velvety nap, while others make finer distinctions, classing one as a "face-finished cassimere," a second as a "saxony," with velour slightly different from either of these. The claim is made that the term properly belongs to a fabric which has had the nap raised by gigging, and is not rightfully applied to cloths which owe their nap entirely to the fulling process. To obtain satisfactory results in the manufacture of fabrics of this character the selection of the wools to be used is a very important detail, as the finish desired is affected very materially by the stock used in the manufacture of the yarns. The wool should be fine, with a good capacity for felting, not too long in staple and

of good strength, shorn wools being much better than pulled wools for several reasons. The wool shorn from the living animal is stronger and possesses more life and elasticity than that pulled from pelts of animals that have been dead for some time, and has not been subjected to the action of harsh chemicals used in the process of pulling.

The scouring of the wool should be carefully done, and no harsh alkalies used as detergents. Untold harm may be done by improper scouring or the use of impure materials in the process. A pure potash soap and soft water are the prime necessities in wool scouring, and care must be taken to insure the use of a scouring liquor that is not too hot; in no case should the scouring bath be warmer than 125 to 130 degrees Fahrenheit. Excessive heat and impure materials have been the means of causing difficulties in subsequent operations that are well-nigh insuperable. With well-selected stock, thoroughly cleansed from impurities, the carding and spinning operations should encounter no difficulties, and yarns spun from such stock will be sound, even and strong, giving

Excellent Results in the Weave Room

in the way of production, with a minimum amount of broken ends or picks. The goods must be well burled, all knots raised and clipped off, leaving the ends long enough so that in the fulling they will not shrink back and leave a hole. After sewing, the goods are ready for the fulling mill, and must be evenly soaped. This is a matter of seemingly minor importance, but much depends upon the even distribution of the soap over every part of the piece. It will be necessary to full the goods endwise as well as in width to get the best results. On fine goods five per cent should be sufficient to give a satisfactory cover.

In scouring it will usually be found that enough soap remains from the fulling to hold the dirt and grease in suspension and allow of its being floated out by means of an application of warm water. If the pieces do not lather up freely in the washer, draw off the dirty liquor, rinse well, close the gates and add fresh soap. Half an hour in the soap, half an hour with warm water to wash it out and a final rinsing with cold water until every trace of soap is removed should result in clean goods and bright colors. Before drying, the goods are napped either on the teasel gig or wire napper until the nap is sufficient for the finish desired, then put on the wet brush to straighten and lay the nap before drying. After the goods are dried they are brushed, steamed, examined for knots, etc., sheared, brushed, sprayed and pressed. The finished piece has a fine, smooth face, with a handle very close to that of a fine piece of suede leather. Many of the so-called velours are not gigged at all, the whole nap being formed in the fulling mill, but these are readily detected, as the nap is not full enough to make a good cover for the face and the goods appear more or less thready.

Layout:

3,840 ends; reed 12—4 = 80" + 1½" for listing = 81½" over all.
50 picks.
Finished width 56".
Finished weight 13½-14 oz.

CALCULATIONS.

3,840 ends 5 run = 7.68 oz. + 10% take-up .....= 8.45 oz.

50 picks 5½ run $\frac{50 \times 82.5}{550}$ .....= 7.41 oz.

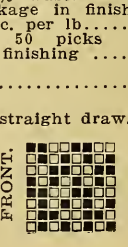
Loom weight ..... 15.86 oz.

COST.

15.86 oz. + 15% waste = 18.7 oz.
+ 5% shrinkage in finishing = 19.6 oz. @ 52c. per lb.....= $ .637
Manufacturing, 50 picks + 5% shrinkage in finishing .....= .420

Mill cost $1.057

Eight harness, straight draw.



RATINÉS

Among the many novelties which have appeared in cotton goods recently there probably is none which has been more popular than the so-called ratiné fabrics. In spite of the fact that a very large percentage of dress goods novelties are short lived in popular demand, usually lasting but one season, this fabric, because of its adaptability to a variety of uses, bids fair to be as popular in worsted for fall and winter wear as its prototype has been in cotton for use in the summer season. The fabric is of low texture, both in ends and picks, yet has not the usual objection to such construction, the peculiar characteristics of the yarn employed in its manufacture preventing the sleazy appearance which frequently results from a loose construction. The success which has attended the marketing of well-made ratinés is easily attested by the

Numerous Imitations

which have been offered as substitutes. The true ratiné is produced by means of using a novelty twist in the warp, while the imitations are usually made of carded woolen threads which are purposely carded and spun in such a manner as to produce a rough, uneven yarn which will approximate as nearly as may be the appearance of the novelty twist. By the use of a low-grade nibby silk noil, mixed with a medium or fine medium wool, and spun to 2½ to 3 run a very creditable imitation of the fabric can be produced. In preparing a lot of stock it must be borne in mind that the silk must not be oiled before picking. In laying out the lot, place a layer of wool first, which should be given a sprinkling of the lubricating emulsion, then a layer of silk noil, followed by another layer of wool, which will have the emulsion as before. The silk will absorb all the oil necessary from the wool below and aboye it. In feeding the batch to the picker, do not take the stock in a haphazard manner, but start at one side, taking the stock from top to bottom of the pile, that the mixing may be done as thoroughly as possible. Stock of this nature should have at least three runs through the picker, which will result in a homogeneous mixture.

The Cards

should be set quite open in order to obtain the best results in a yarn of this description. Instead of making every effort to have the resulting thread smooth and even, the opposite effect is desired. The thread should be as rough as possible. By "open set" the carder will understand that the workers on the first and second breaker cards are to be set farther from the cylinder than is the usual custom, but not so far that the stock will not be carded at all. The desired result is to have the nibs or flakes of silk noil pass through in their original form, or as nearly so as may be. The finisher will require setting a trifle closer than the first two cards or the web will not go to the rings in good condition. The spinning process is not different from the usual procedure for ordinary woolen yarns. As a result of the open setting the nibs of silk retain their form, while the more lofty wool is carded out to a greater or less extent, and in the process of spinning the wool draws and twists, with the nibs of silk noil standing out on the surface quite prominently. The finishing of these imitation ratinés presents no unusual difficulty, practically the only process which differs from the procedure of finishing fancy cassimeres is the shearing, which, in the case of the type of fabrics here described, consists of running them with the blade set well off, the object being to even the nap without disturbing the nubby effect which is the distinguishing characteristic of the goods.

The yarns for making worsted or true ratinés are prepared in a totally different manner. The manufacture of the original or foundation threads is not dissimilar from the ordinary process. It is only in the twisting that the yarns differ from those used in ordinary fabrics. To obtain the novelty effect in goods of this type it is necessary that a

Special Type of Twister

be used. Instead of the ordinary twister such as is used for making the ordinary plain, double and twist effects, a machine must be used which has a double set of rollers that will permit the delivery of the two threads at different speeds. In the fabric here described the ratio of yarn delivery is two to one. The comparatively great cost of this novelty thread is readily understood when we take into consideration the labor cost of its manufacture. To prepare the yarn for weaving it must again be twisted, this time a single yarn being twisted around the product of the double roll twister to hold the loops in place during the further process of manufacture. This is termed the "wrapper" and is significant of its purpose.

The composite thread is made up of three distinct parts, the core or base, the loop thread and the wrapper. A great variety of these novelty twists can be produced on the double roll twister with the knotter. The

Fabric Construction

is as follows: The warp is dressed one end novelty yarn, one end common two-ply, with the filling all plain two-ply yarn. For the novelty yarn three sizes of worsted are used, 2-40s three-eighths blood for the core, one-eighth to three-eighths blood for the loop thread and 1-26s quarter-blood for the wrapper. As comparatively few weaving mills have their own worsted spinning plant, it will be unnecessary at this time to go into the details of the yarn manufacturing process, especially as it is our intention to publish a series of articles at some future date taking up in detail every process of yarn making from grease wool to finished product by both the woolen and worsted systems. Instead of having ordinary size numbers, as is the case with common single or ply yarns, novelties are usually sold as having a certain number of yards per ounce or pound, and the price per pound known, these two factors render our cost calculations comparatively simple. Owing to the cost of yarns of this type, with their relatively coarse size, it is very important that the weight should be looked after very closely. A comparatively slight loss in yards per pound on yarns of large diameter will materially affect the cost of the fabric. A large proportion of these goods are woven from yarns in the grey and colored in the piece, although the use of skein or slub-dyed yarns will enable the manufacturer to obtain a variety of extremely attractive styles.

Layout:

1,344 ends; reed 11½—2 = 64" + 1½" for listing = 65½" over all.
28 picks.
Finished width 54".
Finshed weight 9½ oz.

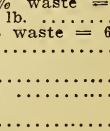
CALCULATIONS.

672 ends 2/36s ⅜ blood = 1.07 oz.
+ 10% take-up .....= 1.17 oz.
672 ends loop, 1.793 yards per lb.
5.99 oz. + 10% take-up.....= 6.58 oz.
28 pks 2/36s ⅜ bl. $\frac{28 \times 65\frac{1}{2}}{(36 \times 560 \div 2) \div 16}$ = 2.81 oz.
Loom weight ..... 10.56 oz.

COST.

3.98 oz. + 5% waste = 4.17 oz.
@ 80c. per lb. .....= $ .2085
6.58 oz. + 5% waste = 6.9 oz. @
$1.20 .....= .5175
Yarn cost ..... $ .7260
Manufacturing .....= .2000
Mill cost ..... $ .9260

4 harness, stralght draw.



There are a variety of fabrics which are practically in the same class as the ratiné described above, some of them differing in name and others in weight or texture, but all owing their distinctive characteristics to the

novelty yarn used in their construction. One of the most common methods of reducing the cost of any article is to use a lower grade of material in its construction or to substitute a fabric which not only costs less but is entirely different in composition. The latter is the method used in producing the novelty yarn from which the so-called

Mistral

cloth is fabricated. To the ordinary layman it presents the appearance of a worsted ratiné and is cleverly constructed, probably with that end in view. A slight investigation of the thread, however, betrays the fact that of the three threads composing the novelty yarn only the loop thread is worsted, the core being a two-ply cotton, with a single cotton thread used as a wrapper. The fact that it contains cotton is in no way harmful to the fabric, per se, as the wearing qualities of the garment made from a fabric of this construction would in all probability be fully equal to those of its all-wool neighbor. This cloth is lower in texture than the ratiné previously described, though of practically the same weight. There are but 20 threads to the inch in the warp, with 21 picks per inch in the filling. It is frequently the case that fabrics of a low texture are liable to slip, but that tendency is overcome in this instance by the character of the yarn. The dyer may have some difficulty in getting the shade on the worsted and cotton to match exactly, which is very essential, otherwise the goods will have a peculiar mottled appearance instead of the full, solid shade desired. A little care in the selection of the dyestuffs used should enable the dyer to obtain results that will be entirely satisfactory in every respect. A fabric made in this manner by a mill equipped with the necessary twisting machinery should prove to be a

More Profitable

proposition than many of the more ordinary types of goods, and should certainly leave a greater margin for profits than an identical cloth made by a mill which must buy the novelty yarns ready for use. An additional advantage in having the twisting equipment is in the fact that it will obviate the necessity of waiting for yarns at times when delays are extremely expensive. The saving in the cost of the yarn will be in itself a considerable item during the season, and should result in an appreciable increase in the net earnings of the plant. There is a very decided advantage in fabricating the season's styles with a low texture if feasible, as the low number of picks will give a greatly increased yardage per loom and reduce the overhead charges per yard to a very great extent. The yarns to be used in making the novelty thread are bought all ready to put on the twister, the cotton on cones and the single worsted on spinning bobbins, so that the only expense is for the labor of twisting. The warp yarn will require spooling, but the filling can be woven direct from the twister bobbins, a saving of the expense of winding when the yarns are purchased in the spool. The yarns used for making the twist are, for the core 2-50s cotton, for the loop thread 1-24s worsted, for the wrapper 1-24s cotton, making the novelty yarn 4,048 yards per pound. The calculations herewith are for goods to finish 42 inches.

Layout:

Warp, 840 ends novelty twist; reed, 8½—2 = 48½" + 1½" for listing = 50" over all.

Filling, 21 picks.

CALCULATIONS.

840 ends, 4,048 yards per lb. = 3.36 oz. + 7% take-up.....= 3.59 oz.

21 picks = $\frac{21 \times 50}{4{,}048 \div 16}$ .....= 4.15 oz.

Loom welght ..... 7.74 oz.

COST.

7.74 oz. + 5% waste = 8.12 oz. @ 80c. per lb. ..... $ .406

Manufacturing ..... .172

Net cost ..... $ .578

CLAY WORSTEDS

For many years the clay worsted was the most popular staple for men's wear, no man's wardrobe being complete without a suit of black clay worsted. Its place to-day is filled by a variety of fabrics, but none of them can fully take the place of the clay. It was woven in a six-harness twill of high-grade yarns, not necessarily fine spun, with a clear finish. The result was a cloth with a full, round twill, every thread clear cut, and a soft, full handle. For the production of these goods the yarns should full and round with two turns less twist than is ordinarily put in yarns of a corresponding size. The warps are dressed on a sectional machine, as in the manufacture of fancy worsteds, beamed and then placed in the slasher for sizing. This is far superior to the system of wet dressing employed in some plants, as it permits of operating the dresser at a much higher rate of speed,

Increasing the Production

very materially, and also sizing the whole warp at one operation, which secures much more even results and better work. The weaving is invariably done on the two-loom system, a considerable saving in the cost of production. The finishing of clays differs but little from the process employed for other piece-dyed, clear-finished cloths. The burling and mending are performed in the customary manner, and the goods scoured with a pure, neutral soap. For fine quality yarns there is nothing superior to a well-made potash soap. It is a well-known fact that soda compounds of all kinds have an injurious effect on the wool fibre, which is particularly noticeable on the finer wools. There is a decided tendency to make the wool brittle and harsh to the touch, which detracts very materially from the soft, kindly feel desirable on this class of fabrics. The scouring should easily be accomplished without the use of harsh detergents, as only the best of oils should be used in the manufacture of the yarns, and these are readily saponified. From the washer the goods are taken to the rolling machine, passing through a trough of hot water over a stretch roll, which removes all the wrinkles, to a winding drum, that carries the roll on which the goods are wound. The pieces should be allowed to remain on the rolls for at least twenty-four hours, during which time the rolls should be turned end for end four times to prevent the water settling in any part of the goods. The pieces are next put through a

Continuous Crabbing Machine,

which gives the goods a thorough "set" and puts them in good condition for the dyer. There should be no trouble in bringing these goods from the dyehouse free from shades or streaks if the preliminary work has been done in a thorough manner. Upon a searching investigation it will almost invariably be found that the cause of uneven goods lies outside the dyehouse. If troubles of this nature are encountered, it would be well to give close attention to the scouring and crabbing operations, as in the majority of

cases the source of the difficulty will be found here. The pieces should have plenty of cold water to rinse off all traces of loose dyestuff and are then ready to be extracted and dried. The drying of fine goods should not be hurried, as the excessive heat necessary for rapid drying is very apt to hurt the handle of the goods. The

Best Method of Drying

is in the open air, but entails too much labor and loss of time for a mill with a production of any size. The system in common use in modern mills is to dry artificially with hot air. The best type of machine is the chain dryer, which carries the cloth between steam-heated coils by means of pins set about a quarter of an inch apart in the links which perforate the selvage and tenter the goods to the desired width while carrying it through the dryer. After back-burling, the pieces are given a few runs on the "polisher" in order to loosen up all the stray fibres and clean out the twill. The shearing must be carefully watched, so that no holes may be cut in the goods. The blade must be set with the center of the axis level with the edge of the ledger blade in order to give the threadbare finish characteristic of clays. After brushing, it is advisable to give the pieces a run over the dewing machine before pressing, which will assist in setting the finish. Run the goods through the press with the face to the cylinder and roll them up hot, allowing them to cool off on the roll. Before inspecting, give a light run on the dewing machine with the face up, and the result will be a firm, fine feeling clay of which any finisher may well be proud.

Layout:
4,800 ends 2/28s; reed 12—6 = 66 2-3" + 1⅓" for listing = 68" over all.
58 picks 2/28s.

CALCULATIONS.

4,800 ends 2/28s = 9.8 oz. + 7% take-up ..... = 10.49 oz.

58 picks $\frac{58 \times 68}{28 \times 560 \div 2 \div 16}$ .... = 8.05 oz.

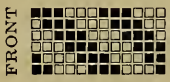
Loom weight ..... 18.54 oz.

COST.

18.54 oz. + 5% waste = 19.47 oz. of yarn required @ 84c. per lb.. = $1.022
Manufacturing ..... = .300

Mill cost $1.322

Draw listing, reverse from the warp, six outside ends, two in heddle. 12 harness straight draw.



CORKSCREWS

The corkscrew is a fabric in which the entire face is composed of warp threads so interlaced as to give the appearance of interlocking spirals, and receives the name from the fancied resemblance to the utensil generally used in the extraction of corks. They may be developed in piece dyes or fancy worsteds, in mixtures or with the alternate wales of contrasting colors. The weave is also very effective in combination with other weaves for producing novelties in fine men's wear.

Not many years ago the corkscrew was an extremely popular fabric, and deservedly so, but the special opportunity presented by this weave for the use of an inferior filling which was taken undue advantage of by some manufacturers soon placed it among the undesirables. Another feature

which militates against a revival of the vogue it once enjoyed is the fact that unless made from fine stock the corkscrew will wear shiny in less time than many other fabrics. To obtain the best results in a fabric of this character the yarns for the warp should be dry mule-spun, that is to say, made on the

French System,

as this method of spinning worsted yarns produces a somewhat softer thread than the Bradford or oil-spun system, and also a thread that has less tendency to shine after the goods are worn. The filling yarns are not as important, as they do not show on the face except in combination weaves, and may be worsted, wool or cotton, as the necessities of the case demand. The sample selected for analysis is a double-colored warp with silk decorations in combination with the brochet weave. The yarns used are 2-40s worsted and 120s silk for the warp with 2-40s and 1-19s for the filling. The weave employed is the thirteen harness corkscrew, which produces a very fine twill at an angle of approximately 30 degrees. This is the weave generally used for the manufacture of fine shoe-top fabrics, and will be found very satisfactory for fine cloths in men's wear styles.

LAYOUT.

Dress:

44 times. { 1 blue / 1 black / 1 blue / 2 black / 2 silk 120 / 2 black

95 × 6 = 570 ends to section.
9 sections

5,130 ends.

6×

Reed 12—6—7—6—6—5 = 67½" + 1½" for listing = 69" over all.

76 picks:
1—2/40 black.
1—1/19 black.

CALCULATIONS.

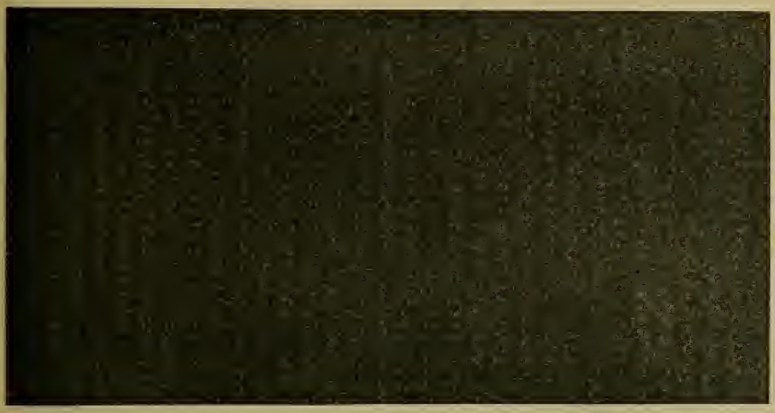
5,022 ends 2/40 = 7.18 oz. + 10% take-up =	7.890 oz.
108 ends 120 silk = .017 oz. + 10% take-up =	.019 oz.
38 picks 2/40 =	3.750 oz.
38 picks 1/19 =	3.930 oz.
Loom weight	15.589 oz.

COST.

11.64 oz. 2/40 + 5% waste = 13.22 oz. @ 90c. per lb. =	$ .7436
.019 oz. 120 silk + 5% waste = .02 oz. @ $4 per lb. =	.0050
3.93 oz. 1/19 + 3% waste = 4.05 oz. @ 80c. per lb. =	.2025
Stock cost	$ .9511
Manufacturing =	.4500
Mill cost	$1.4011

COTTON WORSTEDS

The cotton worsted is a fabric with an almost unlimited number of variations in its construction. When well made, it fills its proper place in the lines of many of our manufacturers of the cheaper grades of clothing. When rightly constructed, there is no fabric made which will return, in wear, better value for the money invested than this much-maligned fabric. Despite the great outcry against so-called "adulterated fabrics," the



Cotton Worsted.

cotton worsted occupies a place in the manufacture of clothing that no other fabric can fill. It gives the clearness of detail in design that can be found in no other cloth but the fine, fancy worsted, which is too high in price for the clothing manufacturer to use in his low-priced lines. The present prejudice against the fabric is to a great extent a manufactured sentiment. The manufacture of these cloths is similar to the processes used in the production of its higher-priced prototype, and

Requires Skilled Workmen in Every Department.

It is quite probable that it will require much less sewing, as the superior strength of the cotton in the warp will be found to save many broken ends in the weaving. Every face thread must be carefully sewed in, and all knots, slugs, etc., removed. The scouring will require special attention, or injury to the colors will result. The shearing must be close, so as to bring out the pattern and colors, but do not press too hard or the goods will have a peculiar papery handle that is extremely undesirable. Cotton worsteds are of three general classes, those with all-worsted face, worsted face warp with cotton filling, and those in which the colored

threads in the warp are worsted. The layout herewith is for a worsted face warp and cotton filling.

LAYOUT.

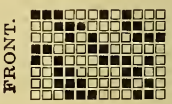
6,048 ends; reed 15—6 = 66" + 1½" for listing = 67½" over all.
58 picks.

CALCULATIONS.

4,032 ends 2/50s worsted = 4.6 oz. + 10%	= 5.06 oz.
2,076 ends 2/30s cotton = 2.56 oz. + 10%	= 2.81 oz.
58 picks 2/40s cotton	= 3.73 oz.
Loom weight	11.60 oz.

COST.

5.06 oz. + 5% waste = 5.31 oz. @ $1 per lb.	= $ .3320
2.56 oz. + 5% waste = 2.68 oz. @ 36c. per lb.	= .0603
3.73 oz. + 5% waste = 3.92 oz. @ 44c. per lb.	= .1078
	$ .5001
Manufacturing	.3750
Mill cost	$ .8751



RATINÉ SERGE

The popularity of the ratiné, which has been one of the best sellers on the market in cottons for summer wear, has led to the development of numerous fabrics of similar appearance in wool and worsted for the fall season. We have previously published full manufacturing details of two

Ratiné Serge.

of these fabrics, made with special loop yarns, and this week have selected for analysis a fabric which is made from plain yarns. The special feature of this example is the use of fine yarns for the warp, with a comparatively heavy filling, which, in combination with the weave employed, produces a novel effect. The yarns for both warp and filling are single worsted, such as may be produced by any mill with regular equipment, and should be much less expensive than the novelty yarns used in the manu-

facture of true ratinés. The peculiar effect is produced by interlacing the warp and filling with the regular cotton weave for the most part, the raised appearance on the face resulting from floating the filling over a portion of the warp. The fabric may be produced on any fancy loom which will hold fourteen harnesses. The fabric should be laid a trifle wider in the loom than ordinary clear finished cloths, to allow for a sufficient contraction in width to bring the floats prominently on the face of the goods. The major part of these cloths are made in piece-dyed shades, but very pleasing results are obtained by the use of contrasting colors in warp and filling. A variety of styles may be made by using black warp and white filling and then piece dyeing, forming a black warp with filling dyed to any desired shade.

LAYOUT.

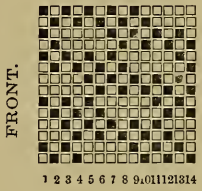
3,224 ends; reed 14½—4—3 = 63.3" + 1½" for listing = 64.8" over all.
38 picks.

CALCULATIONS.

3,224 ends 1/32 = 2.88 oz. + 10% take-up =	3.16 oz.
38 picks 1/16 =	4.39 oz.
Loom weight	7.45 oz.

COST.

3.16 oz. + 3% waste =	3.25 oz.
4.39 oz. + 5% waste =	4.61 oz.
3.25 oz. @ 70c. per lb. =	$ .1503
4.61 oz. @ 64c. per lb. =	.1844
Stock cost	$ .3347
Manufacturing =	.2300
Mill cost	$ .5647



TRICOTS

There are two distinct classes of fabrics known to the trade as tricots. The first, more correctly designated as "tricot a long," is made with wool warp and filling, and is a warp faced cloth. The second is frequently made of all cotton warp with woolen filling and is the fabric commonly known as tricot. The cloth has the appearance of fine lines running either in the direction of the warp, in the tricot long or crosswise in the tricot. A few years ago many of our woolen mills were busily engaged in the production of one or the other of these well-known cloths. In the better grades the tricot long is a fine, firm fabric with excellent wearing qualities, and when made from well-blended mixtures of harmonious colorings, well deserved the title "Fine Suitings," which in these days is often applied to cloths that are much less deserving of such a name. The manufacture of fine woolens such as these is an art little understood by many of the present generation of mill managers, and demands no little skill on the part of the overseers, particularly in the finishing room. The wool used should be fine, well-grown stock, free from burrs, and of good strength.

Care in Scouring

is essential if the best results are to be obtained. Too often the scouring is left to low-priced help, with the result in many cases that a lot of wool intended for fine spinning is so mistreated that it is impossible to draw it to the size desired. In scouring fine wools, particularly, it is absolutely essential to use the best of materials as detergents. They should be tested for impurities of various kinds, not alone to avoid paying fancy prices for material that is of no assistance in removing the dirt and grease

from the wool, but also to be sure that they contain nothing that will have a deleterious effect on the fibre itself. It is a fact beyond the hope of successful contradiction that soda ash or the various other commonly used soda compounds have a very harmful effect on the physical structure of the wool fibre and should never, under any circumstances, be allowed to come in contact with fine wools. The result of their use will be the partial, if not total, destruction of the fine serrations that are one of the chief characteristics of the fibre, and also give it a crisp, harsh handle, similar to stock of a much lower grade and correspondingly lower price. Nothing better has yet been devised for cleansing fine wools than a pure, well-made potash soap, the alkali is much milder in its action than soda, and the fact that potash salts are a constituent of the "yolk" or wool grease itself is evidence that it is not harmful in its nature. Even in potash soaps there will be found at times free caustic alkali, an extremely harmful substance to place in contact with wool, for, if present in sufficient quantity, it will entirely dissolve the fibre. The test for its presence in soap is very simple. A drop of phenolphthalein on the soap will show the presence of free caustic alkali at once by the pink color immediately developed. Another prime requisite is a plentiful supply of

Soft Water.

If the water contains salts of lime, the soap is decomposed, the fatty portion uniting with the acids in the lime compound, which is also disintegrated, forming a lime soap, which is insoluble in water and is deposited on the wool in the scouring liquor. The lime soap is a sort of sticky paste which envelopes the fibre completely and is removed with extreme difficulty, if at all. If not thoroughly cleansed, the stock is difficult to dye properly and is very apt to be uneven. Injury to the stock frequently is the result of excessive heat in the scouring liquor. In no case should the temperature be over 130 degrees Fahrenheit and is preferably kept from 120 to 125 degrees. The goods will have a much better handle if the stock is dried by the cold air process, but many of our manufacturers do not use this system from lack of room or various other reasons. This method of drying requires more time and greater facilities than artificial drying, but gives much better results. The wool is spread in a thin, even layer on wire screens suitably supported, and the under part of the racks boxed in. A powerful fan connected to an opening at one end of the boxed-in rack exhausts the air under the wool, drawing the air in the room through the wool, thus aiding in the drying operation, or forces air into the lower part of the dryer, which causes a current of air to pass upward through the wool on the screen. The latter method is to be preferred, as the wool is left in a more open and lofty condition for subsequent operations. In preparing the lots for the cards, the overseer of the card room should see that the blending and oiling is given proper attention. Lots containing a very small per cent of one color will require different treatment than lots made up of nearly equal quantities of the various colors or stocks. There are various opinions as to the

Best Oil to Use

for lubricating the fibre during the carding and spinning, but for fine wools certainly an oil should be chosen which will not only perform its functions as a lubricant, but also can readily be washed out of the finished goods. It is not an uncommon occurrence to have serious difficulty in the finishing room as a result of using an inferior oil on the stock. The laying down of the lot for the picker should be done in such a manner that there shall be a thorough mixture of the various colors or stocks in the finished batch. A lot made up of four colors or stocks should be laid out with alternate thin layers of each in as nearly equal quantities as possible, and in feeding the picker, the stock must be taken from top to bottom of the

pile. If this is done the result will be a homogeneous mixture throughout. The cards should have clothing set with comparatively fine wire for the wools used in fine tricots. The first breaker may be clothed with No. 28 wire, and No. 30 on the second breaker and finisher. The cylinders of the first two cards are usually covered with sheets, but for the cylinder of the finisher,

Fillet Clothing

is preferable. The roving should be made twice the weight of the yarn desired, giving half draft on the mule, which will make a sound, well-rounded thread that will weave with no difficulty. Goods of this nature, which require considerable fulling or shrinkage in the finishing process, must be laid wide in the loom, from 70 to 72 inches will usually prove sufficient to give excellent results. The finishing of tricots, or other clear finished woolens, require the services of a skilled man, both in the fulling and dry finishing. The burling must be carefully performed, all knots, slugs, etc., removed before the goods go to the sewers, who will replace all threads out and similar imperfections. This part of the work must not be slighted, as every warp thread shows very distinctly on the face of the finished cloth. For the fulling, a pure, well-made soap should be used, the combination used by many of our expert finishers on this class of goods being half tallow and half palm oil, while others prefer to use the palm oil soap entirely. The soap should be applied in such a manner as to secure an even distribution on all parts of the piece, and the use of a soaping machine is advised for this purpose. The soap should be sufficient in quantity to thoroughly moisten the goods, and strong enough to start the grease and dirt in good shape and to hold it in suspension through the fulling operation. The use of a pure tallow soap is open to some serious objections, one in particular being the extreme difficulty with which it is scoured from the goods. The washing machine should have a plentiful supply of both warm and cold water, soft water being much the best if it can be obtained.

The pieces should be run for half an hour with sufficient warm water to form a good lather. If a good, full-bodied soap was used in the fulling, this should be accomplished without the use of additional soap. Rinse for 20 to 30 minutes in warm water, using enough to float the dirty soap and other impurities from the goods in a thorough manner and give a final rinsing for half an hour or possibly three-quarters in cold water. If the goods have been made with a mixture of low stock they may require another application of soap to thoroughly cleanse them before the final rinsing.

Clear Finished Woolens

require more or less work on a gig or napping machine, in order to raise the fibres which have become filled to a greater or less extent in the fulling and washing operations. After drying the goods are "back burled" and taken to the gig or the wire napper, as the case may be. It is necessary to use good judgment here, as a severe application on either machine will result in making the goods tender, one of the worst forms of imperfection that can occur. Goods that are damaged in many other ways can be sold for a variety of uses, but tender goods are practically worthless except as rags. The napping operation must be carried on until, in the judgment of the finisher, the nap is sufficiently well raised for the shear to clean the face of the goods, without setting so close as to injure the thread itself. The shearing must not be unduly hastened, for better results will be secured by coming down slowly, with more runs, than it is possible to obtain by attempting to shear too closely at first. The fine sewers should now repair any damages that have escaped observation before this time, the pieces given a good brushing with a little steam during the final run, and they are ready for the press. The pressing should be moderately heavy on this class of goods, with a light steaming on the

face as they leave the press. With well selected wools, good workmanship, and proper equipment, the finished fabric will be a credit to any manufacturer.

LAYOUT.

4,200 ends; reed 15—4 = 70" + 1½" for listing = 71½" over all.
64 picks.

CALCULATIONS.

4,200 ends 5¼ run = 8 oz. + 10% take-up =	8.80 oz
64 picks 5½ run =	8.32 oz.
Loom weight	17.12 oz.

Finished weight 14 oz.

COST.

17.12 oz. + 15% shrinkage = 20.1 oz. @ 52c. per lb. =	$ .653
Manufacturing	.432
Mill cost	$1.085

The Filling Face Tricot

is a type of construction seldom used except for very cheap cloths. In nearly every instance the warp is entirely of cotton and is purchased on loom beams, obviating the expense of yarn making and warp preparation. The warps may be white or colored, as is best suited to the type of fabric to be made. If the goods are to be piece dyed, the usual method, the warps should be of cutch cotton. The successful manufacture of these goods is one of the simplest branches of the industry, requiring no special skill to produce a satisfactory cloth. The chief aim of the whole force is production, which should be obtained with comparative ease. The warps should run practically from start to finish with scarcely a broken end, leaving the weaver free to watch the filling. There are two kinds of filling used, a comparatively fine thread for the face of the goods, with a much heavier thread for the back. The peculiar ribbed appearance of the goods is due to the weave in part and also to the use of the large backing thread. An inspection of the chain plan used will show at a glance how the effect is obtained. It will be noticed that when the backing pick is put in the

Weave Is Reversed,

the harnesses that were raised for the previous face picker are lowered and vice versa. This reverse in the weave, combined with the comparatively coarse yarn used as back filling, make the distinct cut filling wire which is the distinctive characteristic of this cloth. The stock used in the face filling is medium wool and shoddy, that for the backing a lower grade of wool with a larger percentage of shoddy. It is customary to use picked stock for fillings of this kind, that is, shoddy that has not been carded since coming from the rag picker. As such stock usually contains occasional lumps and hard twisted threads, it is best to have the first breaker card equipped with a

Metallic Breast.

This consists of a series of rolls covered with garnett wire which works the stock before it reaches the tumbler and transfers it to the main cylinder of the card. The speed of the rolls is slow, so that their action on the lumps and hard ends is not harsh, but pulls them apart and puts the stock in good open condition for the card itself. The clothing for cards running on this grade of stock should be set with somewhat coarser wire than for fine all-wool work. The first breaker should not be finer than No. 26 wire with 28 for the finisher. The condensers must be set close and the roving well rubbed in order to spin well.

The finishing of cotton warp tricots is not much different from the routine process. It will be necessary to put some weight on the crimping box to prevent the goods from stretching during the fulling. A heavier soap will be necessary than for all-wool goods, with probably an extra

quantity of alkali to overcome the effect of the impurities in the shoddy. In the majority of cases it will be unnecessary to gig the goods, the cut showing sufficiently without this treatment. Shearing too closely will bring the cotton warp into view, an effect that will render the goods practically unmarketable. In a well finished piece of tricot there cannot be seen a trace of the cotton warp on either face or back, the filling covering it completely on both sides. Their chief use is as a material for cheap skirts.

LAYOUT.

4,500 ends 1/16 cotton; reed 15½—4 = 72½" over all.
54 picks:
2 4 run.
1 2 run.

CALCULATIONS.

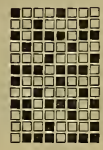
4,500 ends = 5.36 oz. + 5% take-up	=	5.62 oz.
36 picks, 4 run face	=	6.48 oz.
18 picks, 2 run back	=	6.48 oz.
Loom weight		18.58 oz.

COST.

5.62 oz. cutch cotton @ 24c. per lb.	=	$ .0843
6.48 oz. + 15% shrinkage = 7.62 oz. @ 34.2c. per lb.	=	.1623
6.48 oz. + 20% shrinkage = 8.01 oz. @ 20c. per lb.	=	.1201
		$ .3667
*Manufacturing		.3000
Mill cost		$ .6667

*Low cost of manufacture is due to the fact that there are no costs for warp aside from stock.

4 run mixture:		
60% medium wool @ 45c. per lb.	=	$ .270
40% shoddy @ 18c. per lb.	=	.072
Cost per pound		$ .342
2 run mixture:		
20% wool @ 40c. per lb.	=	$ .080
20% cotton @ 12c. per lb.	=	.024
60% shoddy @ 16c. per lb.	=	.096
Cost per pound		$ .200

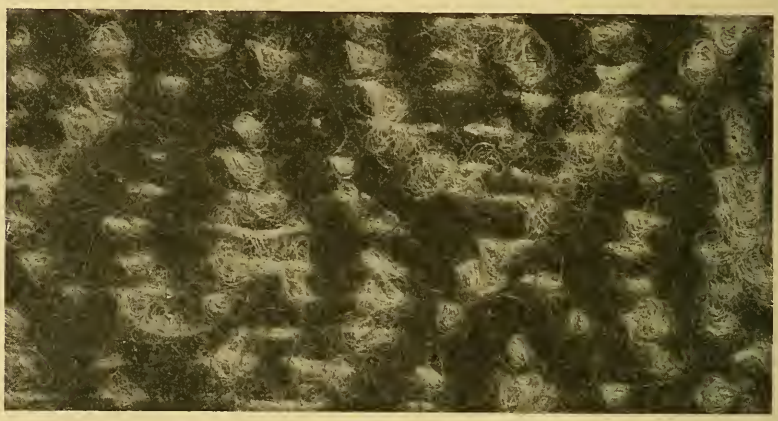


NOVELTY CLOAKINGS

It is interesting to note in relation to the discussion now going on in these columns as to the possibility of arriving at a system of cost finding for woolen mills that the figures as to weights and costs of the novelty presented in this issue were made up by the designer in the mill producing the fabric. The cloth was analyzed by another textile manufacturer whose figures are practically identical, the variation being less than one per cent. This certainly is prima facie evidence that an accurate system is within the range of possibility. The subject of novelty cloakings has been discussed at some length in a previous issue, but the popularity of these fabrics the present season is one of the features of the market, and a further discussion of cloths of this type we think will prove of interest to our readers.

A great many of these novelties would appear to conservative people as being almost too conspicuous for wearing apparel, although such does not seem to be the case with the majority, judging from the sale that these fabrics enjoy. There is a much larger profit derived from the sale of these novelties than from suitings. A great many small mills obtain their sustenance from these same fabrics, competition being too keen in the suiting line to compete with the large mills. People are willing to pay a good price for novelties in the cloth line as well as in any other line. Hardly a day passes without the

appearance of a novelty fabric at the mill, and while no doubt exists as to their being copied in cheaper fabrics, it is found more difficult to do so than would be the case regarding suitings, as luster worsted yarns form the component part, said yarns being used mostly for fillings that stand out conspicuously on the face of the fabric. The warp in these par-



Novelty Cloaking.

ticular fabrics is generally composed entirely of cotton, the same being obscured on the face. Some have a luster worsted filling face with a shoddy mixture back, which is added to give weight to the cloth, quality of the same being not of much importance, the manufacturer using his own judgment in regard to the formula of this yarn, each having his own idea of the same. To determine about what width these fabrics should be set in the loom good judgment must be exercised.

In case they are set too wide, the worsted yarn is liable to break up before the required finished width is attained.

From 68 to 71 Inches

would be found to be a safe width in a majority of these. The worsted yarn, although woven straight, forms a curly surface during the finishing process. Previous to finishing these goods they should be tacked to insure evenness in fulling. They are then put through a soaping machine, so as to acquire an equal distribution of the soap. Close attention must be given to the goods during the fulling process, so as to detect any breaking up of the worsted yarn. Should same happen to occur following this, the pieces are washed and dried, then pressed, no shearing or other process being required. A great many of these cloths are piece dyed, and if such were the case, the goods should not be fulled to width, they being taken out of the fulling mills wide enough to allow for the shrinkage in width during the piece-dyeing process. Good judgment must be used as to the

speed of the dye kettle, for if it is run at too high speed the goods would be much too narrow by the time they were ready to be taken out.

Two-tone piece-dyed effects are very often desired, and are usually woven white and black. The pattern of same might be 1 and 1 or 2 and 2, in fact, any desired pattern as the case may be. The white is dyed to the required shade, the black remaining intact. The color effect might be red and black, blue and black, or in fact any color desired along with the black. The novelty fabric given herewith is a popular one, and is finding ready sale in the market. It is shown here in white and black but may be piece dyed if desired.

Layout:
1,920 ends, 9 × 3 = 71" + 1½" for listing = 72½" over all.
36 picks.

Warp:
Black cotton 2¼ run.

Filling:
White worsted 3s—1
Black wool 1 3-16 run—2 2
Black worsted 3s—1
Loom weight 32 oz.
Finished weight 25 oz.

CALCULATIONS.

1,920 ends 2¼ = 8.54 oz. + 7% take-up	= 9.14 oz.
6 picks 1-6 white	= 4.14 oz.
6 picks 1-6 black	= 4.14 oz.
24 picks 1 3-16 black	= 14.66 oz.
Loom weight	= 32.08 oz.

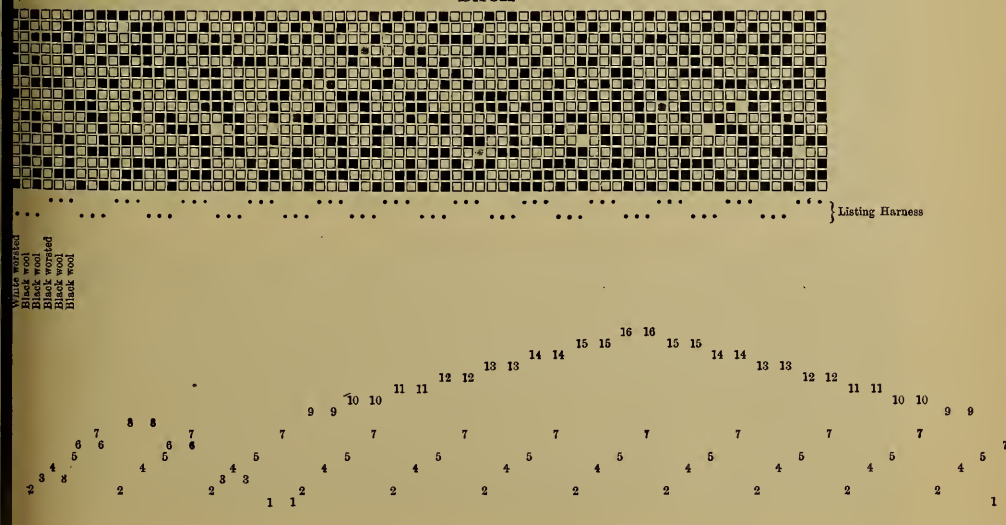
COST.

4.14 oz. white worsted + 5% waste = 4.65 oz. @ 68c. per lb.	= $ .1976
4.14 oz. black worsted + 5% waste = 4.65 oz. @ 78c. per lb.	= .2266
14.66 oz. woolen + 20% waste = 18.59 oz. @ 20c. per lb.	= .2324
9.14 oz. cotton + 15% waste = 10.46 oz. @ 12c. per lb.	= .0785
Cost of stock	= $ .7351
Manufacturing	= .3000
Mill cost	= $1.0351

WOOL MIXTURE.

20% wool @ 40c. per lb.	= $ .080
20% cotton waste @ 12c. per lb.	= .024
60% shoddy @ 16c. per lb.	= .096
Cost per lb.	$ .200

BACK



DUVETYN SUITINGS

Duvetyns are fabrics having a fine silky nap, in appearance somewhat resembling a velvet, but differing materially in the method of manufacture. The pile of the velvet is made in the loom and formed by cutting the loops of silk formed in the weaving process, while the surface of the duvetyn gets its soft velvety nap during the process of finishing. It is one of a great variety of the fabrics technically known as "face finished cloths." The retail price of these fabrics bears but a slight relation to their intrinsic value, the retailer being governed in fixing his selling price more by the fact that the fabric is a novelty than by the cost. That few purchasers are able to form an intelligent opinion as to the real value of fabrics is a statement strongly confirmed by an examination of some of the offerings of these fabrics by several of our large department stores. Prices on practically identical fabrics vary from a dollar to a dollar and a half a yard and in some instances an inferior fabric is priced higher than another of really greater value in the same house. A fabric offered at retail, in one instance, at $5.25 per yard is identical with that offered at $4.75 by another concern and is sold by the mill on regular terms for $1.62½. The retailer

Evidently is Obtaining a Greater Profit

than is ordinarily the case, and more than really is warranted under the circumstances. The manufacturer certainly is justified in feeling that the profits are somewhat unequally distributed and that the high cost of living should not be attributed to him entirely. The manufacture of this type of cloth should not be so difficult as to deter anyone with the necessary equipment from engaging in its production. The important feature wherein it differs from the ordinary type of goods is in the stock mixture used for the filling and the process of finishing. The necessary machinery is usually found in any well equipped plant. The warp is usually entirely of worsted yarns, either single or two-ply, depending somewhat on the quality of the fabric to be produced. The filling is composed of wool and silk waste in the true duvetyn or may be entirely of wool in the imitations. The warp yarns may be bought in the open market or manufactured by the mill. The larger factors in the dress goods trade all have the necessary machinery for the manufacture of worsted yarns, thereby avoiding the delays incident to having yarns made by outside parties, and also, by no means the least important consideration, making a considerable saving in the cost of production. Yarns used in dress fabrics are to a great extent combed from

Crossbred Wools,

the South American and New Zealand stocks forming the principal sources of supply, though some domestic wools as well as Australian crossbreds are also used. The details of manufacture of worsted yarns for dress goods are not essentially different from the ordinary methods, and need not be enlarged upon at this time, as we propose to devote sufficient space for a thorough discussion of that subject in a separate article. The manufacture of the filling necessary to produce the peculiar finish is unlike the usual process in a few essential details. In order to obtain the soft handle peculiar to these cloths, it will be necessary to select a fine, soft wool to blend with the silk used in making the filling. For this purpose the fine twelve-months Texas is an excellent stock. Care must be used to secure a wool free from burrs, or to have them all removed before the stock is carded, in order to avoid the

necessity of picking them from the goods in the form of specks. A very important part of the preparation of the stock is the

Scouring the Wool.

In many mills this process is neglected, or left in charge of low-priced, unskilled help, with the inevitable result that the work is not properly performed, and the stock so damaged that it is impossible to use it for the purpose for which it was intended. The most common source of injury to the stock in the scouring process is the use of excessive heat in the scouring liquor, which, in combination with the harsh alkali, too often used as a detergent, has an extremely injurious effect on the physical structure of the wool fibre. The peculiar felting properties of wool are in a great measure due to the unusual structure of the fibre itself. Viewed under a microscope it is far different in appearance than when seen by the unaided eye. The fibre is seen to be composed of three distinct parts: the center a pith-like canal, formed of soft globular cells, surrounded by a layer of somewhat elongated, tapering cells, which form the greater part of the fibre. Surrounding the whole is a layer of flattened cells, or horny scales, with a high luster in well-grown, healthy wool. This outer layer of scales completely covers the fibre and is attached to it at the lower end, the outer portion free from and projecting a little from the body of the fibre. These scales form the so-called serration or imbrication of the wool filament, and are one of the principal causes of the felting properties peculiar to wool, and found in no other fibre to so great a degree. The number of serrations, together with the natural curl of the fibre, determine the felting qualities of the wool almost entirely. The injury of these tiny scales in the scouring process will have an effect on the working properties of the stock which would seem to be very much out of proportion to the damage done. For

Scouring Fine Wools

only the best of materials and soft water should be used. The use of soda compounds in wool scouring is much to be deprecated, particularly in the cleansing of the finer staples. The action of the alkali is harsh in the extreme, and has a tendency to render the wool less capable of being spun to fine counts, and also to have a harsh, unkindly feel in the goods. The best detergents procurable should be used, and tests made to be sure that they are free from impurities of various kinds, not that all impurities are of an injurious character, but that the price paid may be for value received. The most common form of impurities found in soaps are China clay, silicate of soda and resin as well as common salt. None of these have any value as scouring agents, and are simply added for the purpose of increasing weight. A few simple methods of testing soap should be familiar to every one. The excess of water may be easily determined by weighing accurately a small portion of soap, shave into thin slices and dry until it ceases to change in weight, the loss of weight representing the moisture. For earthy and heavy adulterants a simple test may be made in this manner. A small quantity of the soap is dissolved in water, and sulphuric acid (H_2SO_4) added to the solution. The soap is disintegrated, the heavy impurities sink to the bottom and the grease and resin float. Nothing better has yet been devised for wool scouring than a well made, pure potash soap. This is much preferable to any form of soda soap or compound of any nature containing soda. The presence of free caustic alkali in the detergent must be guarded against, as this, in sufficient quantity, will dissolve the wool fibre. It may be easily detected by means of an extremely simple test. A drop of phenol phthalein placed on the soap will immediately turn pink in the presence of free caustic alkali. For scouring our wool we will use a pure, neutral potash soap with soft water. This latter item is important, as hard water is very apt to create

trouble in later processes. Its action may be briefly described in this manner. The acid in the lime salts, which causes the hardness of the water, unites with the tallow and fats in the soap which is disintegrated, forming lime soaps which are insoluble in water and are deposited on the wool in the scouring bath. It is well-nigh impossible to remove this sticky, pasty substance which envelopes the fibre completely, but if not thoroughly freed from this lime soap at this time further operations are attended with considerable difficulty, particularly the process of dyeing, uneven results being a usual occurrence. In the scouring process the heat of the liquor is another item of seemingly minor importance, but such is not the case. Under no circumstances should the temperature of the scouring bath be allowed to rise beyond 130 degrees Fahrenheit, and a temperature of 125 degrees Fahrenheit is to be preferred. It is a common error to hasten the drying with too high a temperature. By far the best method of drying wool is without the use of artificial heat. Cloth made from wool dried in the open air will have a much better handle than that in which artificially-dried stock is used. If it is necessary to hasten the drying, the cold air method should by all means be used if possible. This is accomplished by forcing a current of air at its natural temperature through the wool by means of an exhaust fan or a blower.

The dye kettle often is the scene of injury to the spinning qualities of the stock, and improper handling or

Too Much Boiling Will Damage the Fibre

so that it will be of much less value than stock which is of lower grade but has received proper treatment throughout. In preparing a lot for the picker which contains silk, care must be taken to oil only the wool. The silk will absorb all the oil required from contact with the wool stock. The lot should be laid out with alternate layers of silk and wool, in as nearly proportionate parts as possible, and put through the mixing picker a sufficient number of times to make a thoroughly homogeneous blend. The cards must be sharp and set fairly close to comb out the fibres and complete the mixing. It may be necessary to slow up the fancy to avoid throwing out the silk, which is very lofty, and is readily charged with electricity. The condensers will require to be set a trifle closer than on all-wool yarns of the same weight. The spinning of this stock will not materially differ from an all-wool thread. As before stated, the warp is entirely of worsted and is prepared as usual. The weaving proceeds in the customary manner, and the burling is done as is the custom on ordinary cloths. In preparing for the fulling mill, a soaping machine is necessary to secure an even distribution of the soap over every part of the piece. The soap should be a full-bodied palm oil base built up with sufficient pure alkali to saponify the grease and oil and hold it in suspension through the fulling and washing operations. If the soap is pure and of good body it should retain sufficient vitality to cleanse the goods without any reenforcement in the washer. Use plenty of warm water to float out all the excess soap and impurities before rinsing. Cold water may be used to rinse the goods, which must be thoroughly clean before going to the napper. Goods of this character must be

Wet During the Napping Operation,

which may be performed on a wire napper or the teasel gig. Water renders the fibre soft and pliable, so that the nap can be raised with much more ease and a great deal less waste of stock than would be possible were they dry during this process. After the nap is well raised, the pieces are placed on the wet brush to straighten and lay the fibres, after which they should be taken to the cropping shears to even up the nap and remove any long fibres. The next process is a repetition of the brushing and a treatment by steaming to increase the luster. This is accomplished by rolling on a per-

forated roller and forcing steam through the piece. The goods are now ready for drying and tentering, the usual method being to place them on a chain dryer, which tenters and dries in one operation. The pieces should now be inspected, steam brushed and are ready for market, no pressing being necessary, as it is desired to have the nap stand up similar to a pile fabric.

LAYOUT.

3,360 ends; reed 12—4 = 70" + 1½" for listing = 71½" over all.
60 picks.

CALCULATIONS.

Warp:
3,360 ends 1/30 worsted = 3.2 oz.
+ 5% take-up .....= 3.36 oz.

60 picks 6 run = $\frac{60 \times 71.5}{600}$ .....= 7.15 oz.

10.51 oz.

Stock mixture:
50% fine Texas @ 52c.....= $ .26
50% silk @ 56c.....= .28

$ .54

COST.

3.36 oz. + 5% waste = 3.54 oz. @ 80c. per lb. .....= $ .177
7.15 oz. + 15% waste = 8.41 oz. @ 54c. per lb. .....= .284

Stock cost ..... $ .461
Manufacturing, 60 picks .....= .375

Net mill cost ..... $ .836

The above described fabric is a plain-faced cloth and a popular type for the present season. There are many variations and styles of these goods shown in striped effects produced by the introduction of silk threads at intervals so interlaced with the filling as to form a distinct cut or stripe on the face, as a result of there being no nap at the points where the warp is composed of silk threads. Many of these striped fabrics have no silk in the filling mixture, are woven in the grey and cross-dyed with dyestuffs which do not color the silk, forming stripes of a contrasting color with the ground. We present herewith a layout for a fabric of this type of construction:

LAYOUT.

4,200 ends; reed 10—6 = 70" + 1½" for listing = 71.5" over all.
60 picks.

CALCULATIONS.

2,940 ends 1/30 worsted = 2.8 oz.
+ 5% take-up .....= 2.94 oz.
1,260 ends 60/2 silk = .4 oz. +
5% take-up .....= .42 oz.

3.36 oz.

60 picks 6 run = $\frac{60 \times 71.5}{600}$ .....= 7.15 oz.

Loom weight ..... 10.51 oz.

COST.

2.94 oz. 1/30 worsted + 5% waste = 3.087 oz. @ 80c. per lb.....= $ .154
.42 oz. 60/2 silk + 5% waste = .441 oz. @ $3.40 per lb. .....= .094
7.15 oz. 6 run + 15 % waste = 8.41 oz. @ 54c. per lb. .....= .284

Stock cost ..... $ .532
Manufacturing, 60 picks .....= .375

Net mill cost ..... $ .907

A very much superior type of duvetyn is that made from two-ply yarns in both warp and filling. An example of a fabric so constructed is offered in one of the best Fifth avenue stores at $5.50 per yard, forty-seven inches in width. In another department of the same house is found a duvetyn made entirely of silk at $6.50 per yard in forty-three inch goods. This is a direct importation and is by far the best example of this type of fabric yet seen. The warp of the part woolen cloth is spun from fine, long-staple wool, such as a fine territory, and the filling is composed of fifty per cent fine wool blended with fifty per cent silk waste spun to eight run slack twist, twisted to the left, then doubled with six turns per inch to the right, making the equivalent of a four-run filling. A fabric of this construction should be a much better type for the mill from a production standpoint than those first described. The superior weaving qualities of a two-ply warp made from fine wool is not to be questioned, and should reduce the overhead charges somewhat. The process of manufacture is not materially different from that for the less expensive types described above, nor is the difference in the finished fabric so markedly apparent to anyone not familiar with fabrics. The

greater intrinsic value of the latter type of construction will be readily recognized by the trained buyer, and will shortly be demonstrated to the wearer by the rapidity with which the poorer material becomes shabby and the garment made therefrom shapeless. In no class of merchandise is it more readily proven that the best is ultimately the cheapest.

LAYOUT.

3,024 ends; reed 13½—4 = 56" + 1½" for listing = 57½" over all.
44 picks.

CALCULATIONS.

3,024 ends 2/48 worsted = 3.6 oz.
+ 5% ..... = 3.78 oz.

44 picks 8 run 2-ply = $\frac{44 \times 57.5}{400}$ = 6.325 oz.

Loom weight ..... 10.105 oz.

Filling mixture:
50% fine wool @ 52c..... = $ .26
50% silk waste @ 56c..... = .28
$ .54

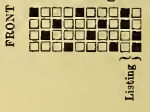
COST.

3.78 oz. + 5% waste = 3.98 oz. @ 96 cents per lb. ..... = $ .239
6.325 oz. + 15% waste = 7.44 oz. @ 54c. per lb. ..... = .251

Stock cost ..... $ .590
Manufacturing, 44 picks ..... = .375

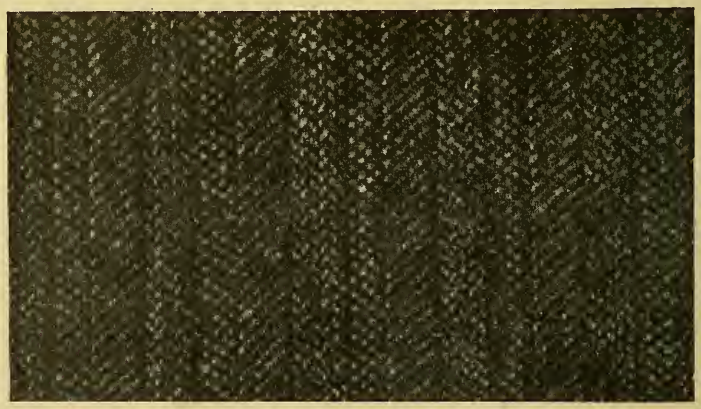
Mill cost ..... $ .965

8 harness straight draw.



DOUBLE AND TWIST SUITINGS

There are certain styles in men's wear which it is impossible to produce by the use of worsted yarns, and which always appeal to those in search of something a little out of the ordinary. Among the fabrics of this type, the fine woolen made from high-grade wool in two-ply yarns is a favorite with many of our best merchant tailors. It possesses many advantages over the fine worsted cloth, in that it is susceptible of being



Double and Twist Suiting.

developed in rather bold designs without becoming glaring, the softness of the yarn blending the outlines of the pattern into an extremely harmonious whole. It retains its shape and fresh look longer, and after press-

ing has the appearance of a new garment. For the best effect, the wools should be from well-grown, healthy fleeces with fair length of staple.

In Scouring,

especial care should be taken to prevent injury of the fibre by harsh alkalies or excessive heat of the scouring liquor. The drying of the stock should be accomplished by the natural or cold-air method, rather than resorting to artificial heat, as the goods manufactured from such stock will have a much softer handle when finished. Avoid excessive poling in the dye kettle by the use of level dyeing colors whenever obtainable, and, above all, do not boil longer than is absolutely necessary to get the shade and fasten the color properly.

Stock may be injured to such an extent in the operation that it will be found impossible to use it for the purpose for which it was intended. The stock must be well opened and oiled in the picking, the cards in first-class order and set fairly close. For work of this character the clothing should be set with fine wire on all the cards of the set. The first breaker should have wire not coarser than No. 30, with No. 32, or better yet, No. 34 for the second breaker and finisher. With wire of these sizes in good condition there will be no difficulty in producing a thread that will be as nearly perfect as can be obtained. The roving should weigh three run for six-run yarn. For the slack twist thread use two more holes of twist than for filling yarns of corresponding size. The twisting may be done on a mule or on the ordinary twisting frame as may be the more convenient method. The twist should not exceed eight per inch for trousering cloths or six turns per inch for suitings. The warps may be dressed on a dry frame, no size being necessary for yarns of this quality and size.

The expense of finishing goods of this description will be less than for the ordinary single yarn cloth, owing to the superior strength of the two-ply thread. The loom production should reach 85 per cent of the possible capacity, materially reducing the weave room expense per yard. The burling should be done over a sloping table, perfectly smooth, and preferably covered with a sheet of tin or zinc. The hard, smooth surface presented by the metal enables the burler to detect the knots and slugs or bits of foreign matter requiring removal much more easily than can be donc on the uneven surface of the ordinary wooden bench. Every thread out, mispick or broken pick must be replaced by the sewers before the goods are sent to the wet finishing department. The

Soap Must Be Free From Impurities

of all kinds and evenly applied to all parts of the pieces, either by means of a soaping machine or by applying it to the pieces as they are in motion in the fulling mill. For goods with white warps, scouring before fulling may be advisable, but should not be necessary except in rare instances, and should not be resorted to unless absolutely necessary, as it requires more time, labor and material, increasing the cost of finishing to a considerable degree. If the stock has been properly handled in previous processes, fulling in the grease will be found to give excellent results. For goods of this grade the soap should be a pure palm oil, made up with sufficient mild alkali to cut the grease and hold it in suspension throughout the fulling operation. When the goods have been running ten minutes they should be tested to see if the soap is doing the work as it should. The piece may be given a twist between the hands, when, if the fulling is progressing as it should, the dirt and grease will ooze out with the dirty soapsuds, or the cloth may be held over the fingers and the thumb nail scraped up against them, the impurities gushing out with the soap as in the other method. Do not full to the width required, but allow at least an inch for shrinkage in the further processes of finishing.

The washing should be started with half an hour's work in warm, not hot, water, which should float out the soap and dirt. Open the gates and rinse thoroughly, then float the goods with the cold water, rinse, drain and extract. There should be no occasion for adding soap in the washer, as with clean stock and pure materials, the soap used in the fulling should retain sufficient life to thoroughly cle-anse the goods in the washer. The drying is done on one of the various forms of artificially-heated machines, which also tenters the goods to the desired width. After drying the pieces are back-burled, brushed and sheared. If necessary to clear the pattern, they may be given a light run on the gig, but the better plan would be to reed them a trifle narrower in the loom, and so lessen the fulling required to bring them to width. After shearing, they should be brushed, sprayed and given a moderate pressing, face to the cylinder. After pressing, give one run on the dewing machine, inspect and roll.

LAYOUT.

2,400 ends; reed 8½—4 = 70" + 1½" for listing = 71½" over all.
44 picks.

CALCULATIONS.

2,400 ends 6 run D. and T. = 8 oz.
+ 10% take-up .....= 8.80 oz.

$$44 \text{ picks} = \frac{44 \times 71.5}{300} \text{ .....} = 10.49 \text{ oz.}$$

Loom weight ..... 19.29 oz.
Finished weight 17-17.5 oz.

COST.

19.29 oz. + 15% = 22.7 oz. @ 52c. per lb. .....= $ .738
Manufacturing .....= .379

Mill cost $1.117

8 harness.

SERGES

The manufacture of staples of any kind is one requiring the best of equipment, modern machinery and skilled help in every department, as competition is particularly keen in this branch of the trade. In order to become a factor in the trade, it is practically necessary to carry on the whole process of manufacture from wool to finished fabrics by the same concern. There are comparatively few mills that can go into the market for yarns, weave and finish the goods in competition with mills having their own spinning machinery. Serges, originally, were fabrics made from medium grades of wool spun to about 2-32s for light weights and having the twill clear and distinct. The fabric had a somewhat harsh touch with a distinct rasp when the fingers were rubbed contrary to the direction in which they passed through the press. The yarns used were invariably two-ply for both warp and filling. At present, the term serge covers nearly every fabric made in black or blue piece dye, from the seven-ounce "storm serge" for ladies' wear, made from comparatively low stock with single yarn for both warp and filling, all along the line to fine twills made from high-count yarns of fine quality.

One of the factors, which perhaps is the strongest in causing certain manufacturers to enter the staple business, is that while the margin of profit is smaller than on fancy goods, the market is more dependable. The element of design and coloring is practically eliminated, there is no great outlay for sample purposes before the market opens each season, and a major part of the harassing detail work which is

The Inevitable Consequence

of making fancy goods is entirely removed. Another feature that makes a very strong appeal to the mill owner must not be lost sight of, which is that at the end of the season there is no accumulation of small lots of yarns of various colors, a state of affairs which it is impossible to overcome entirely

even under the best of management in a fancy mill. One of the most important features in the manufacture of serges is the dyeing, which is done in kettles holding from eight to twelve pieces. There is no department in the mill probably that receives so much unmerited criticism as the dyehouse. In other departments it is possible to cover up many mistakes, but there is little chance for the dyer to evade responsibility for any that he may make, and many times it is his misfortune to have the errors of others attributed to him. It is very frequently the case that shady goods are laid at his door, when the real responsibility for them is in some previous process.

It is very essential for both dyeing and finishing that there should be a plentiful supply of soft water, or if this is not obtainable, the hardness of the water must be overcome by chemical means, except in cases of temporary hardness, which is overcome by the simple expedient of boiling. In common with nearly all goods woven in the grey, serges are woven on the

Double Loom System,

one operative having charge of two looms, a practice which reduces the weaving cost very materially. The burling and mending are much easier than on colored goods and need no special mention. The washing is very important, as any trace of soap or dirt allowed to remain in the goods will inevitably cause trouble for the dyer. There is no doubt but that the majority of cloudy goods are caused by insufficient washing or improper treatment in crabbing. When the goods are thoroughly clean, they may be extracted and are then ready for the crab. Many finishers still prefer to use the old style two-hole "Yorkshire Crab," and undoubtedly get very good results. The chief objection to its use is not that the results are poor, but that it is a slow process and requires considerable more labor than the more modern method. There are on the market

Continuous Crabbing Machines

which perform the work very efficiently and with a minimum of labor. If equipped with the two-hole crab, the pieces should be run on with the edges guided carefully so as to make a square-edged roll, run twenty minutes in hot water, then twenty minutes in cold. In the second bowl give the same treatment but continue it for thirty minutes. After rolling from the crab, the pieces should be carefully wound to protect them from dirt and dust. They are benefited by allowing them to remain on the rolls for twenty-four hours before unrolling for the dyehouse. The dyeing should present no unusual difficulty if the goods are clean, but if they contain soap or grease, or have been allowed to stand on one end since coming from the crabbing machine, instead of being turned end for end at intervals, shady goods will result in spite of all the efforts of the dyer. Many dyers boil out the pieces in from 3 to 5 per cent of Glauber's salts as a precautionary measure, and find that it saves a great deal of trouble and worry. In the finishing process following, the procedure is the same as for any clear-finished worsted fabric.

LAYOUT.

3,840 ends; reed 15½—4 = 62" + 1½" for listing = 63½" over all.
64 picks.

CALCULATIONS.

3,840 ends 2/40s ½ blood = 5.5 oz. + 10% take-up =	6.05 oz.
64 picks 1/25s ⅝ blood =	4.60 oz.
Loom weight	10.65 oz.

COST.

6.05 oz. + 5% waste = 6.35 oz. @ 90c. per lb. =	$ .357
4.6 oz. + 3% waste = 4.74 oz. @ 70c. per lb. =	.207
Stock cost	$ .564
Manufacturing, 64 picks =	.260
Mill cost	$ .824

8 harness straight draw.

The above layout is for a 56-inch cloth to finish 9½ ounces, and is a good example of the light-weight serges made with two-ply warp and single filling. The more expensive cloths are made with two-ply yarns in both warp and weft, which give a more durable cloth certainly but one that usually is not of as high a texture. Below we give the layout and full particulars for the manufacture of a heavy-weight serge 54 inches wide, finished weight 15½ to 16 ounces.

LAYOUT.

3,360 ends; reed 13—4 = 64.6" + 1.4" for listing = 66" over all.
54 picks.

CALCULATIONS.

3,360 ends 2/24 = 8 oz. + 10% take-up .....= 8.80 oz.

54 picks 2/24 = $\frac{54 \times 66}{24 \times 560 \div 2 \div 16}$ ...= 8.48 oz.

Loom weight ..... 17.28 oz.

COST.

17.28 oz. + 5% waste = 18.14 oz. @ 80c. per lb. .....=	$ .907
Manufacturing, 54 picks .....=	.275
Mill cost	$1.182

Draw on eight harnesses, straight draft and weave with common twill. While the name serge originally was applied to fabrics such as are described in the foregoing article, it is used to-day in speaking of many fabrics of similar construction which are cross drawn and have a design developed by this means and various arrangements of the chain. The foundation in all these is the four harness even twill, the most used of all the methods of interlacing warp and filling of which we are cognizant.

WOOL PLUSH

The popularity of napped cloths for ladies' coats is one of the features of the goods market the present fall season. One of the close competitors of the chinchilla and zibeline is the so-called wool plush. The fabric as it comes from the loom conveys no idea of the beauty of the finished product. In its unfinished state it resembles a piece of burlap more than a fabric suitable for ladies' wear, but a skillful finisher, with proper equipment, is able to transform the rough, spongy fabric into a thing of beauty. The colorings most favored in these cloths are rose, green and royal blue, although a variety of other shades are shown as well. The fabrication of the wool plush requires no special skill, and their manufacture is not at all difficult.

The most important feature in their construction is the selection of the right stock for the filling. Designers and superintendents, whose entire experience has been in mills making fine cassimeres and overcoatings, are somewhat at a loss when the selling agent places a fabric of this character before them. In these times of strenuous competition on the ordinary fabrics, the ability to produce salable novelties is a considerable asset for any concern. Many mills owe their continued success to their versatility in fabrication and ability to produce the right thing at the moment when it is in greatest demand. Cloths of a novel character command a much greater price in the market than those of more intrinsic value but of ordinary style. The most successful of our mills are those which are able to point the way rather than those who are content to follow. One of the most interesting

features of the fabric here described is the extremely low texture used to develop such a thick nap. The warp is entirely of cotton, thirty ends per inch, the weave a broken four-harness filling satin with twenty-four picks of a coarse woolen thread forming the greater part of the cloth. Manufacturing costs are relatively low, as a

Larger Number of Looms

can be operated per set of cards than is possible when both warp and filling are of carded yarns. To produce goods of this type to the best advantage, the mules should be of wide gauge, capable of using a bobbin of more than ordinary length, so that the operation of doffing may not hinder the yarn production. A copping machine should be a part of the equipment, as the cost of putting the yarn in cop form will be more than offset by the greater production in the weave room, owing to the decreased stoppage of the loom for shuttle changing. Burling and sewing are an almost negligible item in the finishing cost of fabrics of this kind. The warp should run with practically no breakage from morning until night, and due care on the part of the weaver will eliminate the necessity for sewing in broken picks.

The process requiring the greatest care will in most cases prove to be the carding. If the equipment is fitted for the manufacture of fine yarns, a few changes may be found necessary. In the production of heavy yarns from the stock required to produce the desired effect it will often be found difficult to make a side drawing that will carry from card to card without breaking or even to produce the drawing, as the weight of the stock will frequently break down the web under the doffer comb. This is easily overcome by placing a cone-shaped roll the full width of the doffer to support the stock. The cone may be driven from a convenient shaft by means of a belt or piece of spindle banding, with a surface speed approximately that of the doffer. In place of the

Overhead Carriers

in common use with the Apperly feed, a "creeper" may be substituted which will not strain the drawing. The tube for twisting the drawing should have a large aperture and sufficient length to support the drawing directly after it leaves the doffer roll. The condenser aprons should be set with a fairly coarse gauge, excessive rubbing having a tendency to form twits. The roving must be made less than half draft, usually two-thirds will give the best results and form a round, plump thread. The finishing machinery required is that usually found in a fancy cassimere mill, with the addition of a wet gig. The fulling is performed as usual with the goods tacked face inside, then a thorough washing to remove all the dirt and soap, otherwise it will be found extremely difficult to raise the nap nicely, the soap or dirt remaining in the pieces having an effect similar to paste or glue, binding the fibres together in a compact mass. While the goods are still wet, place them on the rolling machine to remove all wrinkles and allow them to stand over night on the rolls if possible.

An important adjunct to the wet gig is a supply of pure, soft water. The nap may be raised much more easily while the fibres are rendered soft and

pliable by the moisture with much less waste of stock. When the napping process is completed, the pieces are ready for the dyehouse, where they are colored in a kettle holding from six to twelve pieces. Do not bring to a boil too rapidly, but give ample time to secure penetration in order to avoid the "hungry" look sometimes seen in piece-dyed fabrics. During the dyeing, it is essential to have the pieces run in such a manner that the water is shed in the direction of the nap. Rinse thoroughly before removing from the kettle, place on the wet brush and have the nap well straightened, then roll on perforated cylinders and blow steam through followed by cold water, change ends, repeat the steaming and cooling, allow to remain on the roll at least six hours, then dry to width. One run on the shear to remove the long fibre is sufficient, give a thorough steam brushing and the goods are ready for market, no pressing being required.

LAYOUT.

Warp:
1,680 ends; reed 6—4 = 70" + 1½" for listing = 71½" over all.
24 picks.

CALCULATIONS.

1,680 ends 2/16 cotton = 4 oz. + 10% take-up .....= 4.4 oz.

24 picks 7/10 run = $\frac{24 \times 71.5}{70}$ ....= 28.1 oz.

Loom weight ..... 27.5 oz.

STOCK MIXTURE.

60% B super @ 40c. .....= $ .24
40% white noils @ 35c. .....= .14

$ .38

COST.

4.4 oz. cotton @ 22c. per lb.....= $ .0605
23.1 oz. woolen + 20% waste = 28.88 oz. @ 38c. per lb.....= .6859

Cost of stock ..... $ .7464
Manufacturing, 24 picks .....= .2544

Net cost $1.0008

8 harness straight draw.

OUTING FLANNEL

No fabric has yet been developed which is better adapted for the use its name indicates than the outing flannel. It is the ideal for tennis or vacation wear, whether at mountain or seashore, and is adapted for either men's wear or ladies' garments. The fabric is light and cool, drapes well and is susceptible of a great variety of uses. It should be made of fairly fine stock spun to five runs or finer in order to secure the firmness desired without becoming bulky or clumsy in appearance. The wools should be carefully sorted and all defective locks thrown out. Especial care must be given in the scouring operation to avoid injuring the working qualities of the wool. The soap used should be a well-made potash compound free from caustic alkali and impurities of every kind. The scouring liquor in either bowl of the machine should never be warmer than 120 to 130 degrees, as extreme heat has an injurious effect on the fibre and may so

Affect Its Spinning Qualities

that it cannot be drawn to the desired size. During the picking operation there should be an application of four quarts of oil to each hundred pounds of wool. The use of a good red or lard oil is much preferable to the mineral oils, many of which are put out under the name of "Wool Oils." Mixtures in which one of the colors forms a very small

percentage should be run through the mixing picker at least three times in order to secure a thoroughly blended mix. The cards should be in first-class condition, the clothing not coarser than No. 28 wire on the first breaker and No. 30 on the second breaker and finisher. The setting must be sufficiently close to clear the stock, but not close enough to injure the fibre. If the stock has been properly selected and is well carded, there will be no trouble in spinning it at 40 per cent draft, which will insure a strong elastic thread that will weave perfectly. The weave employed in this fabric is the four-harness even twill, and as the goods are laid wide in the loom they will take the picks very easily, in fact the ease of the weave may lead to uneven goods, unless special care is taken to see that frictions on the beam are nicely adjusted, and that the take-up is in good order. With good yarn for warp and filling, the goods should come from the loom in such condition that the burling and sewing will not require much help, four girls should be able to take care of the production of 40 looms easily. Goods of this character are preferably

Fulled in the Grease,

and will require special care in this operation. Unless the fulling room is provided with a soaping machine it would be advisable to remove the stretch plates from the mills and in their place fit up a trough which will guide the cloth into the rolls nicely, having a slight flare toward the front. Instead of applying the soap cold, have it sufficiently warm to flow through the spout of a can similar to an ordinary sprinkler without the spray end. Provide suitable steps or small platform to enable the fuller to reach the top of the mill easily, and when the pieces are ready for work start the mill. Open the top of the mill and pour the soap on the pieces as they pass through the trough to the rolls, vibrating the spout of the can from side to side, so the soap will be well distributed. In an experience of many years, this method of soaping has never failed to give excellent results on light goods that frequently are hard to bring out perfect. All wool flannels will require but a short time to full, and as soon as they are up to width, should immediately be transferred to the washer. No additional soap should be necessary to cleanse the goods thoroughly. First they should have 20 minutes' work in warm water which should lather up in good shape and float out all the dirt and oil in the goods, if, and this cannot be too strongly emphasized, a good oil was used in the picker house, and

Pure Soap

in the fulling. There are many soaps on the market which appeal to the purchaser because of their low price, but in many cases they are much more expensive than a more costly article. For fulling flannels no tallow soap should be used, as in most cases it is washed out with considerable difficulty. A pure palm oil soap free from impurities, with no trace of free caustic alkali is the best for fulling these fabrics. It is advisable to make a test of the soap occasionally to be sure that it is not loaded with various impurities that add weight but have no value as detergents. A small quantity may be dissolved in water, then treated with sulphuric acid. The soap is disintegrated by the acid, the heavy earthy impurities sink to the bottom of the solution, and the fatty portion floats on the top. It is well known that caustic alkali will entirely destroy the wool fibre if in sufficient quantity, and in smaller amounts has a very deleterious effect on the physical structure of the fibre, causing it to be tender and lose the soft handle so much desired. Its presence in the soap may readily be detected by placing a drop of phenolphthalein on the soap, when a pink color is developed if it contains free caustic alkali. Wash the soap liquor off with plenty of cold water and allow the goods to rinse until every trace of soap is elimi-

nated, then dry about two inches wider than the finished width. After back burling they should be inspected before running into the shear. In

Shearing Flannels

the blade must be set off somewhat, as the finish desired is not close. The nap should be fairly thick and the raising brush in sufficiently good contact to lift the fibres into position for the blade to clip them off evenly. Before pressing the goods should have one or two runs on the steam brush which will put them in excellent condition for the press. If rolled on the press and allowed to cool off on the rolls before the final inspection, the goods will not only handle better, but will also retain the finish to a greater degree.

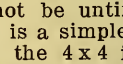
LAYOUT.

2,800 ends; reed 10—4 = 70" + 1½" for listing = 71½" over all.
40 picks.
2,800 ends 5 run = 5.6 oz. + 10% ..... = 6.16 oz.
40 picks 5¼ run = $\frac{71\frac{1}{2} \times 40}{525}$ ..... = 5.45 oz.
Loom weight ..... 11.61 oz.

COST.

11.61 oz. + 15% shrinkage..... = 13.35 oz.
13.35 oz. @ 52c. per lb..... = $ .434
Manufacturing, 40 picks ..... = .360
Mill cost ..... $ .794

8 harness, straight draw.
CHAIN.



SHEPHERD PLAIDS AND TARTANS

The popularity of the various Scotch effects is very much in evidence in the dress goods market the present season, and a description of some of the best known patterns in these fabrics may not be untimely. The shepherd plaid, the best known of any of the tartans, is a simple black and white even check of different sizes. In men's wear the 4 x 4 is probably the size most in favor, while in women's wear the larger sizes predominate. The tartan plaids are varied in sizes and colors from the brilliant contrasts of the Royal Stuart to the dull blues and greens of some of the more lowly clans. There is a wide variety of tartans shown this season in both wool and worsted goods, the type selected for analysis being a woolen fabric manufactured by one of our best known New England mills. The stock used is a B super wool, which can be purchased at prices from 34 cents for a grey suitable for the dark colors and 38 cents for a stock which will color into the lighter shades used. By a combination of these stocks it is possible to make up a stock mixture at a very moderate price. The

Texture of the Fabric

is low, counting 38 ends per inch in the warp and 36 in the filling. The only secret in the manufacture of these goods is open to everyone, modern equipment and efficient management, a combination that is sure to give satisfactory results at any time. The carding and picking are in charge of an expert in the manufacture of yarns from low-grade wools, who is capable of getting the most possible yarn from a given amount of stock. The production of the mules is higher than that obtained in the average mill and of good quality, so that there is no loss of time in the weave room as a result of poor yarns. The finishing of goods of this character is similar to the process used in the making of any ordinary cassimere. All goods are fulled in the grease with a good grade of palm oil soap, free from impurities of all kinds, built up to the required strength by use of a pure, mild alkali. From the fulling mills they are taken directly to the washer, where the grease and dirt are readily floated out in a bath

of pure warm water, which must be soft, if clean goods are to be obtained. The drying is done with a chain dryer in a moderate heat, the goods back burled, brushed and sheared. After shearing they are inspected over a perch and imperfections repaired if any are found. A run over the brush precedes the pressing, which is followed by a final examination before rolling up for shipment.

LAYOUT.

Warp:
2,160 ends; reed 8—4 = 67½" + 1½" for listing = 69" over all.

Filling:
36 picks.

STOCK AVERAGE COST.

70% grey B super @ 34c.	=	$ .238
30% ordinary B super @ 38c.	=	.104
		$ .342
2,160 ends 4 run = 5.4 oz. + 10% take-up	=	5.94 oz.
36 picks 4⅛ run = $\frac{36 \times 69}{4.125}$	=	6.02 oz.
Loom weight		11.96 oz.
11.96 oz. + 20% waste	=	15 oz.
15 oz. @ 34.2c. per lb.	=	$ .321
Manufacturing, 40 picks	=	.275
Mill cost		$ .596
Selling		.170
		$ .766
Profit		.084
Selling price		$ .850

GABARDINE DRESS GOODS

One of the much advertised new fabrics for dress goods purposes is the gabardine, which originally was used solely for the manufacture of outer garments, such as cloaks suitable for protection from the rain. In ancient times the term was applied to the garment itself and had no reference to the material from which it was made, but at the present time the name gabardine is used solely to denote the fabric, which is used for a variety of purposes. In the heavier weights it is commonly used to-day in the manufacture of raincoats, and when so used is usually treated either by chemical means or mechanical applications, so as to render it both repellant and practically waterproof. The methods of waterproofing are many, and the end in view is accomplished in a variety of ways. Some of the goods are treated in the washer with various mineral salts after scouring, while a method pursued by other manufacturers is to

Apply the Waterproofing Material

in the form of a waxy mixture by means of friction of the cloth over a suitable receptacle filled with the substance used, as the goods enter the press. The action of the press, together with the heat present, distributes the proofing and causes it to thoroughly permeate the fibres and become to all intents and purposes an integral part of the cloth itself. It is odorless, colorless and elastic, causing no perceptible difference in the appearance or handle of the goods, but will not permit of water passing through. It would naturally be supposed that such treatment would render the goods impervious to the passage of air, making the garments extremely uncomfortable to wear, but such is not the case, and for this reason, fabrics so treated have to a great extent superseded the rubber-coated cloths heretofore so extensively used in the production of rainy-day garments. It is possible to treat fabrics made from cotton, wool, worsted or mohair so that ordinary suitings may be made waterproof, enabling one to dispense with an extra garment as protection against the inclemency of the weather, if it is so desired.

The larger proportion of gabardines are made in the single cloth construction, though for wear in the colder weather there are fabrics produced

with two systems of warp, having a filling common to both and also true double cloths. The latter type of construction is used almost entirely for the manufacture of fabrics with plain or single tone face, with fancy back, usually in the form of plaids, which give the appearance of a lining to the garment. The manufacture of fabrics of either type requires no special machinery, nor is the waterproofing a process of any particular difficulty. The process of proofing after scouring can be carried on in the ordinary type of washing machine in common use in woolen and worsted finishing rooms, while the "dry" system of proofing requires a suitable receptacle for the proofing material, with means for placing in contact with the face of the goods as they pass toward the press cylinder. In the better grades, gabardines are made from two-ply yarns, both in warp and filling, the less expensive cloths having two-ply warps and single filling. The type of fabric selected for analysis is nine ounces in weight and fifty-four inches wide inside the listing, intended for ladies' suitings. We have chosen a fabric selling at retail over the counter of our department stores at $2.50 per yard. This price

May Seem Extremely High

for a fabric of the weight and texture here described, but it must be remembered that the retail price is of necessity high compared with the mill cost, owing largely to the very extravagant merchandise methods in vogue. This is more especially true of merchandise usually purchased by women. They require large, well lighted stores, with ample show rooms, rest rooms, quick service and, in most instances, delivery of even the most insignificant purchases. This method of doing business entails on the merchant an enormous expense for rent, heat, light, and possibly the greatest of all for service. In this latter item is included the cost of maintaining an elaborate delivery equipment, by means of which milady may have a spool of silk delivered at her residence. All these items are a very material aggregate in the expense of conducting a mercantile business and add not a little to the cost of goods to the ultimate consumer. While it is possible for many mills to market their product for from 3 to 5 per cent, the cost of selling at retail in many instances is over 25 per cent, which, with a fair profit for the merchant, necessitates a considerable advance over the price at which the goods are purchased from the manufacturer.

In order to manufacture piece-dyed gabardines at a fair profit it is almost imperative that the mill manufacture its own yarns. In these days of hard competition on staple and semi-staple cloths no item of saving should be neglected, profits are in the large turnover with expense of manufacture reduced to the lowest possible figure. The successful mill must eliminate, as far as possible, paying profits to other manufacturers by carrying on every process required to turn out the finished goods in its own plant. Another great advantage in so doing is the fact that many tedious waits for yarns may be avoided by a mill equipped to supply its own needs in this direction. The objection may be made that the expense of such an equipment is prohibitive to the small weavers, which may be very true, and it is also true that, as a general proposition, the small weaver should not attempt to manufacture goods which are generally regarded as the logical product of the large corporation. The opportunities for the smaller mill are varied and extensive enough without entering this field. For the fabric under discussion we shall need a

Fine Territory Wool,

which may be purchased in to-day's market at 20 to 21 cents, which, with the ordinary shrinkage, will cost 50 to 52 cents clean. This cost is the average for the whole fleece, and to this must be added sufficient to allow for the lower value of the sorts rejected. The scouring of wools of this

grade should be done with the best detergents obtainable, free from impurities of all kinds and, above all, with no trace of free caustic alkali. A test of the materials should be made frequently, so that no lot may be used with is not up to the standard of quality, not alone to check cost against value, but, more important than the question of cost, to see that they contain nothing which is harmful to the fibre itself. Soaps are possibly the most frequently adulterated materials purchased by the manufacturer and should be often subjected to tests for value and cleansing properties. Adulterants in common use are china clay, common salt, silicate of soda and resin; also an excess of moisture is frequently present. Tests for all these are so simple and well known that they need not be given in detail at this time. It is of the utmost importance that the detergents contain no free caustic alkali, the detection of which is simple and requires no apparatus whatever. A drop of phenolphthalein placed on the soap in question will immediately develop a pink color if free caustic alkali is present. The use of hard water and excessive heat are two things to be avoided in wool scouring, the first from the fact that it is practically impossible to scour wool by its use and the second because too high a temperature in the scouring bath has an injurious effect on the fibre, rendering it less capable of being worked to advantage in subsequent processes. In many cases wool which should easily be spun to 40s or finer cannot be spun finer than 32s or 33s, because of bad handling in the scouring room. Instead of rinsing the stock, as is customary in scouring clothing wools, the last bowl should contain a

Weak Scouring Liquor,

which will act as a lubricant in the carding, and the stock should not be too thoroughly dried, as the slight moisture retained in the fibre will permit of more easily opening the stock in carding, produce less waste in the carding with a material reduction of the noils, as there will be a smaller number of short broken fibres to be removed by the combs. By the use of well selected wools, properly treated, the percentage of noils made may be reduced to 12½ per cent, or possibly less, a material reduction in the ultimate cost of the yarn, as the yarn cost is intimately associated with the quantity which may be spun from a given amount of wool. The intermediate operations, gilling, drawing, etc., usually present no difficulties, but on the roving frames there are opportunities for producing poor work that should be carefully avoided. The top rolls should be examined at frequent intervals and all defective rolls replaced with those that are perfect, so that imperfect yarns and slugs may not cause extra work in the finishing room.

The filling, used single in the example, should have especially good care, as there is no opportunity for inspection of this, it being woven directly from the spinning bobbins in nearly every instance. Inspection of the warp yarns should be thorough and is best performed as the yarns are spooled, or rather run from one spool to another over a board painted black, in the case of yarns in the grey; in fact it will be conducive of better results if yarns to be dyed are

First Spooled and Inspected

in this manner before putting into skeins. While it is the common practice to dress piece-dye fabrics of this character on dry frames and weave without sizing the warps, better results will be obtained if the warps are run through the slasher and given a slight sizing. To many this will appear as an unnecessary expense, but the consequent better production in the weave room with reduced expense of sewing will in most cases overbalance the cost of this operation. It is by such methods as these which tend to reduce the most expensive item in production cost, that is, hand labor, that manufacturing expenses are reduced to a minimum and the production materi-

ally increased. There are probably no mills making this type of fabric which do not operate on the two-loom system, and it is essential that the warps should be as nearly perfect as possible. Careful attention to details that are apparently unimportant are, therefore, required in order that the weaver may be able to give the greater part of his time to watching the filling and avoiding imperfections of various kinds. The fixer should see that every part of the loom is in perfect adjustment to do the best possible work, shuttles smooth, reed straight, and all straps in good condition, with the stop motion in perfect working order. Under these conditions an 82-inch loom with 17-ounce shuttles may easily be operated at a speed of 120 picks per minute. After the cloth is taken from the loom it should be inspected, imperfections marked and the yardage, with other necessary data, recorded on sheets provided for this purpose.

The Burling Requires Care.

All knots should be raised and broken off with ends long enough to prevent drawing back during the finishing. In addition to performing the actual work of burling the operatives should mark every imperfection needing the attention of the sewers, which may have escaped the notice of the percher. The sewers must repair all threads out and mispicks, replace hard twist threads and reduce the slugs or sew in perfect yarns to replace them. All work of this nature should be done in the flannel, if possible, as there is much less liability of its showing in the finished fabrics than if made after the goods have been scoured. From the sewers the pieces are taken to the wet finishing room and should be scoured with a light neutral soap, either a palm oil or potash soap would do the work very nicely. A tallow soap is never advisable for worsted scouring, as it is not easily removed and may lead to serious trouble in the dyehouse. As there is comparatively little dirt or oil in the goods it will not be necessary to use a soap of much body or strongly fortified with alkali. In the majority of cases a mixture of two ounces of soap to a gallon of water with two to three ounces of urine substitute will cleanse the goods thoroughly. Unless the pieces are to lie some time before dyeing they need not be dried but taken at once to the continuous crab from which they will emerge thoroughly set and rolled tightly on wooden rolls, where they should remain at least 24 hours, the rolls being turned end for end at intervals of six or eight hours.

If the goods are free from soap and dirt there should be no trouble in bringing out perfect goods free from shades either from end to end or side to center. Should there be any doubt in the mind of the dyer, it might be well to give them a preliminary boiling out in Glauber's salt. The kettle should not be overcrowded nor brought to a boil too rapidly. When brought to shade cool off, rinse, extract and dry. A run on the brush will put the pieces in condition for shearing, an operation requiring considerable care. The shear itself must be in first-class condition in order to give the thread the finish desired. After shearing, the goods should be perched, and im perfections repaired that may be found, then brushed, dewed and pressed.

LAYOUT.

5,120 ends; reed 16 × 5 = 64" + 1½" for listing = 65½" over all.
90 picks.

CALCULATIONS.

5,120 ends 2/48 = 6.09 oz. + 5% take-up	=	6.39 oz.
90 picks 1/32	=	5.27 oz.
Loom weight		11.66 oz.
Finished weight 10 oz.		

COST.

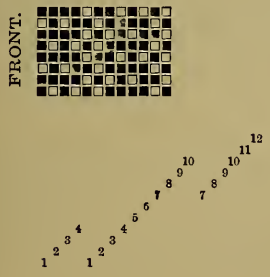
6.39 oz. + 5% waste = 6.71 oz. @ 96c. per lb.	=	$ .4026
5.27 oz. + 3% waste = 5.43 oz. @ 82c. per lb.	=	.2783
		$ .6809
Manufacturing, 90 picks	=	.4250
Net mill cost		$1.1059

BEDFORD CORD

The type of fabric known as Bedford cords are being shown for fall in a variety of constructions and a wide range of colors. It is some little time since these fabrics have been among the leaders in popular favor, and as they are selling well this season, it may be that an analysis of two of the best sellers will be acceptable to our readers. The lighter weights of these cloths are particularly well adapted for suitings and a slightly heavier cloth is made up into coats that are very attractive. The present season they are shown in solid colors as well as fancies, the most popular styles being developed in a line of mixtures with

Silk Decorations.

The manufacture of these fabrics is not particularly difficult and can be undertaken by any mill having fancy looms with a sufficient number of harness. The finishing is the same as for the larger part of worsted dress goods and requires no special machinery of any kind. The warps may be made of either single or two-ply yarns, the filling in nearly every instance is single, woven from the cop or bobbin as it comes from the spinner, without rewinding, a considerable saving in time and lab r. If single yarns are used for the warps, they must be dressed on a wet frame, and well sized, otherwise the weaving will be accomplished with a great deal of difficulty and consequent loss of production. It cannot be emphasized too strongly that success in the manufacture of dress goods or, in fact, of any fabric, is to a very large degree dependent upon the use of stock or yarns suitable for the production of the goods. This is particularly true in the manufacturing of cloths in which single yarn is used for warp. The yarn must be spun from long staple fine wools and given careful attention in every process or the results will be far from satisfactory.



LAYOUT.

3,868 ends; 16 reed, 4 in dent = 62" + 1½" for listing = 63½" over all.
68 picks.

CALCULATIONS.

3,868 ends 1/26 = 4.25 oz. + 10% take-up .....= 4.67 oz.

78 picks = $\frac{78 \times 63\frac{1}{2}}{32 \times 560 \div 16}$ .....= 4.33 oz.

Loom weight ..... 9.00 oz.

COST.

9 oz. + 5% waste = 9.45 oz. @ 75c. per lb. .....= $ .433
Manufacturing .....= .375

Mill cost ..... $ .808

Finished width 52".
Finished weight 8 oz.

Some very pleasing variations from the plain fabric described above are obtained by the use of slub-dyed yarns instead of the grey which was used for the piece-dyed cloth. The designer's skill in weave combination can also be called into play with some very effectiv results, the tasteful blending of colors adding to the beauty of the finished fabric. There are several very pleasing effects of this character among the offerings for the new fall season. Several styles noticed particularly have threads of silk twist to bring out the pattern, while in some of the most attractive the decorative threads are of raw silk. Others are made with the ground entirely composed of nicely blended mixtures or twists of contrasting colors.

Details are given below, for a novelty with a plain warp, and three colors used in the filling, producing an odd spot effect in alternate ribs.

LAYOUT.

3,868 ends; 16 reed, 4 in dent = 62" + 1½" for listing = 63½" over all.
68 picks.

CALCULATIONS.

3,868 ends 1/26 = 4.25 oz. + 10% take-up .....= 4.67 oz.

78 picks 1/32 = $\frac{78 \times 65\frac{1}{2}}{32 \times 560 \div 16}$ .....= 4.33 oz.

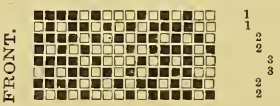
Loom weight ..... 9.00 oz.

COST.

9 oz. + 5% waste = 9.45 oz. @ 85c. per lb. .....= $ .502
Manufacturing .....= .425

Mill cost ..... $ .927

FILLING PATTERN.



Another Example,

showing a different weave combination with decorations of raw silk, is given in the layout below. In this style the ground weave is the eight-harness satin instead of the brochet used in the two previous fabrics. The warp is a two-ply mixture thread, the filling single yarns of the mixture. The comparatively loose weave employed gives a cloth that is much softer than either of those preceding it.

LAYOUT.

4,500 ends; 14½ reed, 5 in dent = 62" + 1½" for listing = 63½" over all.
70 picks.
Finished width 52".
Finished weight 7 oz.

CALCULATIONS.

600 ends 60/2 silk = .19 oz. + 5% .....= .199 oz.

3,900 ends 2/56 worsted = 3.98 oz. + 5% .....= 4.180 oz.

70 picks 1/36 wstd. $\frac{70 \times 63\frac{1}{2}}{36 \times 560 \div 16}$ = 3.530 oz.

Loom weight ..... 7.909 oz.

COST.

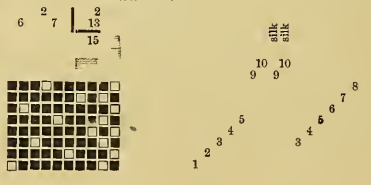
.199 oz. + 5% waste = .209 oz. @ $3.90 per lb. .....= $ .0510
4.18 oz. + 5% waste = 4.39 oz. @ $1 per lb. .....= .2743
3.53 oz. + 3% waste = 3.64 oz. @ 86c. per lb. .....= .1820

Stock cost ..... $ .5073
Manufacturing, 70 picks .....= .4000

Mill cost ..... $ .9073

DRESSED.

60/2 silk.
2/56 worsted.



BEAVERS

In various districts in England the fabric which we call beaver is sometimes designated as kersey, the two fabrics being very similar in many respects, and are therefore often classed as the same. In other districts they are known as a soft-finished kersey, which is the true description of a beaver cloth. Again in Scotland there is a beaver fabric which is altogether different from any of the above. The Scotch beaver is a soft, spongy cloth, something like a chinchilla in construction, well napped, and in place of the chinchilla finish it is cropped to show a fur-like finish. The nap is fairly long, the final napping being done without the use of the laying brush, and the nap stands up fluffy and fur-like.

In our markets the beaver cloth is generally understood to be almost the same as a kersey, but of a softer make, adaptable for ladies' cloakings, and it stands in the same relation in the cloaking trade as the kersey does in the men's wear overcoating market, and it may, therefore, be designated as a sister fabric to a kersey. There are two kinds of beavers, "hard backed," that is, the back is finished natural without any gigging, while the soft backed beaver is made with a quality of stock which can be napped into a soft, fluffy back. Very often camel's hair is used in the backing, and when napped it gives a bulky, soft piece of cloth, with a fine face similar to a kersey. It is usually dyed into fancy shades, such as tans, blues, browns, etc., suitable for the cloaking trade. There has been little or no demand for beavers for many years, the trade being mostly on rough-faced fabrics of a cheviot nature. The

Processes in Manufacturing

beavers are very similar to the manufacture of broadcloths and kerseys, and a fine, good felting wool for the face is absolutely necessary in order to get a desirable nap. The cloth is laid narrower in the loom, as it is not necessary to full so much in width and as less fulling is required in length, the cloth must come heavier from the loom than a kersey cloth, that is heavier in proportion to the finished weight. These are the main points of difference, and the manufacturer must guide himself in making beavers by remembering that they are a soft-finished fabric, not hard like a kersey.

The face yarns, both warp and filling, are spun fine, the average being 4-run warp and 4½-run filling, and in many fabrics it is even spun finer, but when the latter is the case there is danger of getting too thin a face, that is, the veneer of fine yarns is very thin, and unless great care is taken in the napping there is a possibility of getting the face soft and tender, which would render the cloth unfit for use in a serviceable garment. In all face-finished fabrics, such as broadcloths, kerseys and beavers, the finishing process plays a most important part, in fact, the finishing of such goods is the all-important part, and will either make or mar the goods. The finishing process includes everything from the loom to the case. The cloth as it comes from the loom is totally unfit for use. It may be likened to a building which has just passed out of the masons' or bricklayers' hands and is ready for the plasterers, carpenters and painters to beautify and complete. It is in a very imperfect condition, full of knots, broken threads, slubs grease, etc. The aim of the finisher is to remove all these imperfections, cleanse the cloth and restore the natural brightness and luster to the wool.

A mere glance at the different wools used and the various fabrics made for both ladies' and gentlemen's wear will show that several processes are necessary to get the

Various Finishes.

In fact we may say that every variety of cloth has its own peculiar process of finishing which is best suited to give it the most effective ap-

pearance. There is one general point that must be noticed, which is that in the making of cloth the quality and character of the wool has to be considered in reference to the kind of finish wanted. Of course, we can finish a cloth in any way we may choose, but if we wish to obtain perfect goods this point must be kept in mind.

For example, the wool suitable for a Scotch cheviot cloth, where little fulling is required, would be altogether unsuitable for a kersey or a melton, requiring a large amount of fulling. The rule then which regulates this is that cloths requiring a large amount of fulling should be made from fine wools possessing good felting properties, such as fine Ohio XX, fine Texas, Arizona and California wools, and in the foreign wools fine Saxony, Port Philip and other Australian wools, fine Natal or Cape, etc. Let us now take up briefly the preparatory processes of finishing, giving a brief outline, so that the reader who is not initiated into the mill business may obtain some idea of these processes. After the cloth is woven, it is passed over a "perch" in a strong light, and is carefully examined by an inspector, who marks all imperfections of yarns or flaws in weaving. A piece is always examined on both sides, first, on the face of the goods, and second, looking through the goods toward the window, when all weaving imperfections are more easily seen and marked.

Burling.

This is really the first process in finishing. The cloth is placed upon a table, the top part of which can be raised or tilted to any desired angle, and the burlers carefully examine it for knots, slugs, loose ends, etc., by passing their hands over the surface of the cloth, and all imperfections are removed by the use of burling irons. These are sharp-pointed blades, like tweezers, and by them the burlers draw out thick threads, knots and other imperfections of the yarn. It is very important at this stage that all such defects be removed, and especially so in broadcloths, kerseys and beavers, or other face-finished goods, because if any knots or bunches are left in the cloth and fulled in it will be impossible to remove them afterward without leaving a small pin hole.

Some persons may think that the process of napping would cover up any knots, but the fact is that the napping and steaming make them show up stronger, and at this stage it is impossible to correct imperfect and careless burling. Pieces are always burled twice, the back of the piece being done first, all knots being drawn through on the back and cut off, and thick and uneven threads taken out or reduced in thickness; that is, by the use of the burling iron part of the thick thread is carefully removed and part of it is left in the cloth. This may appear difficult, but by practice an experienced burler can quickly reduce a heavy thread. After being burled twice, first on the back and then on the face, the piece is thrown over a perching roll, examined with the cloth toward a well-lighted window, and all remaining knots and imperfections are removed.

Sewing or Mending.

After the burling the pieces are "mended," that is, all broken threads are sewed in and any imperfections in the weave corrected so far as possible previous to fulling, for after the goods are fulled it is hardly possible to sew in threads or repair imperfections. Such goods as beavers, kerseys, meltons and thibets do not require such care in the mending department as worsteds and other bare-finished goods, as the felting of the above-mentioned materials serves to cover up slight imperfections in the weave, but even in these goods a warp thread broken out for some inches will show damage, and broken picks should also be sewed in and all floats and imperfections of weave repaired. If a pick of filling or a warp thread is left out and

needs to be sewed in, the mender will first find out the method in which the warp and filling threads interlace with each other, which is done by picking out an inch or two of the yarn and noting the filling threads crossing with the warp yarns.

This being correctly ascertained, a needle is threaded with the same yarn as that of which the cloth is woven, and the thread is sewed into the cloth, occupying the place of the broken thread, care being taken that it interlaces with the warp yarn in the same order as the other threads. If a thread is uneven and heavy, it is necessary to draw it out and introduce a thread of the proper size. This is done by fastening a length of the correct size of yarn to the uneven or heavy thread, and as it is drawn out of the cloth it is constantly replaced by an end of the correct yarn.

Some cloths are more

Difficult to Repair

than others. Worsted cloth made of fancy and complicated weaves and patterns is very difficult to repair, and it requires the most expert menders to do such work. These cloths are generally handled twice in the mending department. The first process is called "mending in the grease," and is, as the name indicates, done previous to scouring. After being scoured, the goods are examined by an experienced and skillful mender, who marks all imperfections not previously noted and mended, and the pieces are then sent to the "clean sewing" perches for the final mending.

The change which the fulling effects in the appearance and handle of woolen cloths is surprisingly great, and the causes which contribute to these results have given rise to many discussions. It is now the generally accepted theory that the peculiar felting properties of woolen cloths are due primarily to the serratures which form the structure of the fibre. Wool being the only fibre which shows this peculiar structure, and the number and sharpness of these serrations or scales vary in different classes of wools, it is worthy of note that the finest felting wools contain more of these scales per inch than wools which are coarser and do not felt so readily. Thus fine Saxony wool may contain 2,700 to 3,000 scales per inch, while an inferior felting wool may only show 1,000 scales or even less per inch.

The shrinking or felting nature of woolen goods is due also to the varied and innumerable ways in which the fibres are mixed, crossed and interlaced with each other in the yarns. The felting property of wools is also hastened by the application of soap and water, as by its action the outer ridges or scales of the wool fibre are freed from the natural oil or yolk, their serrated edges opened out, causing interlocking of the fibres, and fulling is made possible. The heat, which is generated by the fulling process also plays an important part. It is the combination of heat, moisture and mild alkali which opens the serrated scales of the fibre and knits them together into a close and compact mat or felt.

Years ago the fulling was done entirely by the

Fulling Stocks,

which consisted of a trough-shaped bed, capable of holding several pieces of cloth, and suspended over this bed were two high hammers or mallets, weighing several hundred pounds each, and operated by a sort of trip hammer mechanism, which raised the mallets alternately, allowing them to drop by their own weight on the pieces of cloth lying in the bed of the machine. The force of the blow, combined with the sloping bottom of the bed, caused the cloth to turn over more or less at each blow of the mallet. Thus the position was changed all the time and the cloth received a natural fulling. The chief drawbacks to the use of the fulling stocks are the large amount of space necessary, the slowness of the fulling and the difficulty in regulating them so as to full a piece to a given length and width.

The fulling mill or machine has now almost entirely superseded the old-time stocks. It is based upon an entirely new principle, and is capable of fulling a much larger amount of cloth, and it also requires less space and power. A large machine will full from four to eight pieces of cloth at one time. The cloth is run into the mill, passing through a dividing or guide board over a roller, and through a narrow guide or throat, which delivers it between flanged rollers heavily weighted by springs. These flanged rollers force the cloth into what is called the trap.

This trap has a hinged cover which can be weighted according to the requirements of fulling. The fulling is effected by the flanged rollers forcing the cloth into the trap, the object of the latter being to hold the cloth back and not allow of its being delivered freely. The fulling is accomplished by the continual forcing of the cloth into the trap, and the effect is the same as the hammer of the fulling stock, but instead of repeated blows of the stocks, it is a constant and positive force, driving the cloth forward into the trap until it is forced out at the back end, and as the ends of the pieces are sewed together the operation is continuous. The piece can be fulled to any required width and length by regulating the weight on the cover of the trap. This machine is suitable for almost every kind of cloth, and is indispensable when a large amount of fulling is required, as in meltons, kerseys, etc.

There is considerable heat generated during the fulling process, and it is important to watch the

Rise in Temperature

closely, because if the goods get very hot it will tender the stock, and also cause the goods to full or shrink too rapidly, thus preventing the production of that close felted face so necessary in face-finished goods. The temperature should not be allowed to exceed 80 or 85 degrees, and the results will be more satisfactory at a lower temperature, as in most classes of goods requiring a heavy felted face the longer time taken to full the goods the better felt will be obtained. The process must be continuous, that is, the shrinkage must be kept up continuously, slowly and surely, being knit together in one compact body, both warp and filling.

Assuming now that the cloth is well scoured and freed from all soap, the next process in the finishing of the fabric we have under consideration is the napping. The object in napping is to raise the fibres on the face of the goods to such an extent that the surface of the fabric will show one continuous covering of a soft, fur-like nap. This process was formerly done by hand and was known as "teaseling," the teasels being set in a framework, and the piece of cloth stretched over bars and kept tight by a ratchet and pawl. That process was slow and very unsatisfactory, as compared with present-day operations. The teasel gig was the first improvement, and it consisted of a large cylinder fitted with 24 slats, closely set with teasels, the product of a plant grown in various parts of England, France and in this country in New York state.

This cylinder makes about 150 revolutions per minute and revolves in a contrary direction to that in which the cloth travels, and it thus gives a great power for raising the fibre on the surface of the cloth. The amount of contact the cloth has with the teasels can easily be regulated by means of movable rollers, which are regulated by pinion and rack gear. These are single acting, also double acting gigs, the latter giving four points of contact with the cloth as it passes around the cylinder. The wire gig or napper is the latest machine for raising the nap on cloth.

It is constructed with a number of rollers covered with a bronze wire clothing very sharp, and so arranged with speed gears that as the cloth

passes around the cylinder, these rollers can be so operated that the felted surface is quickly napped and opened out if so desired, and by the mere change of a speed gear the wire-covered rollers can be made to take vigorous hold and nap a piece in less than half the time it would take in a teasel gig. The usual process is to do the first napping on the wire napper, and finish off on the teasels.

All Face Finished Goods,

such as kerseys, broadcloths, beavers, doeskins, etc., are napped wet, but all other goods which are finished clear are napped dry, which causes the fibres to stand erect, ready for the process of shearing, while in the wet napping the fibres are laid flat on the surface of the cloth to form a continuous nap or pile, which completely hides the weave of the cloth. This nap is then cropped by the shear, in order to level the nap, cutting off all long fibres and giving the fabric a close, velvet-like nap.

The object of steaming is to impart a permanent luster to the cloth. This was formerly done by boiling the cloth for several hours in a tank of water, the cloth having been first tightly wound on a wooden roll, generally made of birch wood, as it was free from gum and resin. After the boiling it was plunged into a tank of cold water and laid there for several hours. Then it was rewound onto another roll, thus reversing the ends, and again boiled for several hours, when the cooling off was repeated again in cold water. The whole process usually took several days to complete. The modern method of steaming was explained in the article on "Broadcloths and Kerseys," and the process can be completed in about an hour, which shows a vast improvement in processes of manufacturing during the past fifty years. After the steaming comes the wet brushing, drying, shearing and pressing, as described in previous articles on similar goods.

LAYOUT.

4,800 ends; 4 run warp, right twist.
15 reed, 4 in dent = 80" inside listing + 2" for listing = 82" over all.

FILLING.

Face 4½ run, left twist, spun soft.
Back 2 run, left twist, spun soft.
2 picks face yarn; 1 pick backing.
60 picks per inch.

CALCULATIONS.

4,800 ends, 4 run, warp yarn	=	12.00 oz.
82" × 60 picks = 4,920 picks.		
3,280 face picks ÷ 4½ run	=	7.30 oz.
1,640 back picks ÷ 2 run	=	8.20 oz.
4,920		27.50 oz.
Take-up	=	2.75 oz.
Loom weight		30.25 oz.

7% shrinkage in length in finishing = 26 oz. finished weight.

12.00 oz. warp yarn.
7.30 oz. face filling.

19.30 oz. + 10% take-up in weaving + 10% waste allowance = 23.58 oz
8.20 oz. back filling + 10% take-up + 15% waste allowance = 10.60 oz.

COST.

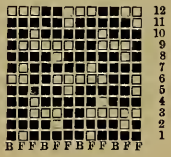
Stock for face yarns:

Fine California carbonized, per lb.	=	$ .4200

Stock for backing yarns:

25% fine California carbonized @ 42c. per lb.	=	$ .1050
25% fine mill waste, light shoddy @ 24c. per lb.	=	.0600
50% fine light shoddy @ 22c. per lb.	=	.1100
Cost per lb.		$ .2750
23.58 oz. stock for face yarns @ 42c. per lb.	=	$ .6190
10.60 oz. stock for backing yarns @ 27½c. per lb.	=	.1835
Plus 7% shrinkage in length	=	.0561
		$ .8586
Manufacturing, 60 picks @ $.0070 + 7%	=	.4494
Mill cost		$1.3080

WEAVING CHAIN.

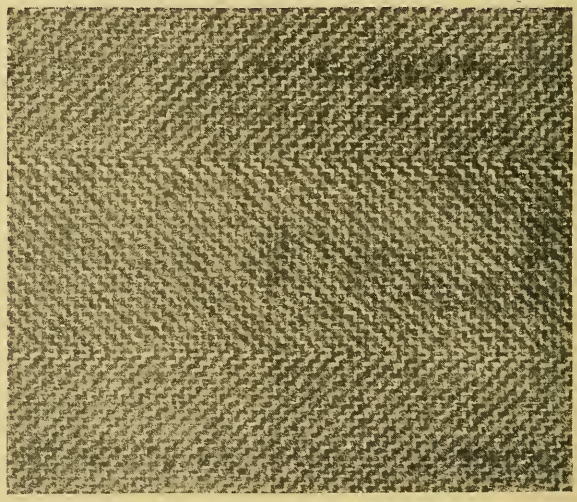


FRONT.

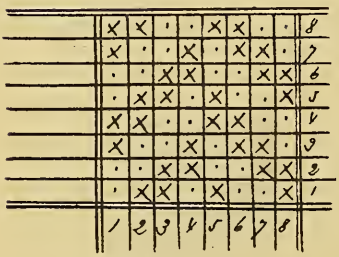
CASSIMERES

Light Weight. 12-ounce Finished.

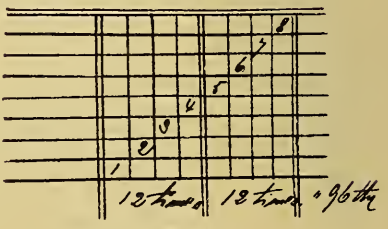
Cassimeres are a staple woolen fabric, made in various grades for men's suitings and in weights for winter and summer wear. They are produced in an endless variety of designs in color and woven effects. Cloth is closely sheared and woven. Full to 52 inches wide and finish the cloth to 54 inches between twisting. Press very hard to give the cloth a smooth and fine look. Spin the yarn to a nice round thread.



Light-Weight Cassimere, 12-ounce.

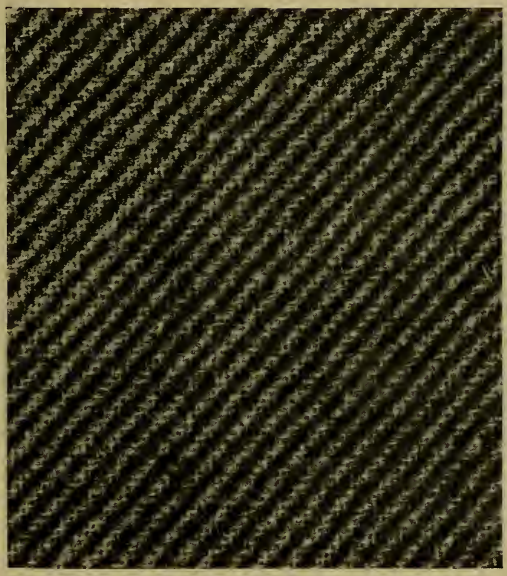


Full Draft.



Drawing Draft.

Full Draft.



Medium-Weight Cassimere, 14½-ounce.

WARP FILLING.

1 medium color.
1 light color.

2

Also made in silk stripes and fancy color overlaid.

8 HARNESS. STRAIGHT DRAW.

Layout:
2,880 ends, 44 picks.
Reed, 10½—4—68, 57″ between listing.
Warp:
2,880 thr., 5 run..... 5.86 oz.
Filling:
44 picks, 5 run..... 6.12 oz.

Allow 2 inches after list.....11.98 oz.
Loom shrinkage, 10%..... 1.20 ″

Loom weight .....13.18 oz.

COST CALCULATION.

Material:
Fine grade of wool, 56c. lb.
16: 56 = 3½c. an ounce.
13.20 + 15% shrinkage = 15.16 ounce.
15, 16 ounce @ 3½c..... = $ .5306
Manufacturing:
44 picks @ 0.86 mills..... = .3784

Mill cost .....$ .9090

FINE PLAID BACK LADIES' CLOAKING

Worsted Face, Wool Backing.

This is a very fine fabric equal to the best imported cloths made from 2-36s slub-dyed mixture worsted, half-blood quality on face warp and 2-36s white and skein-dyed yarn for back warp. The filling yarns are made from fine carbonized wools. The fabric is made in a variety of worsted mixtures and skein-dyed yarns for the face and a number of fancy plaids for the back. No fulling is required, but the cloth should be given a thorough scouring, running the goods in the soap somewhat longer than usual. Extract, gig carefully on back, laying the nap. Dry at 57 inches. Steam and brush both face and back, shear, and press medium pressure. Finish at 55 inches inside listing. Filling yarns—one-half mule draft.

Fine Plaid Back Ladies' Cloaking.

Layout:

2,940 ends 2/36 face warp, slub dyed mixture, ½ blood quality.
2,940 ends 2/36 back warp, white and skein dyed, ½ blood quality.

5,880 ends.
120 ends white listing 2/36 worsted.

6.000
11/8 reed, 66 4-5″ inside listing, plus 1½″ for listing = 68 3-10″ over all.
100 picks.
4½ run filling, right twist.
Spun soft.

WARP PATTERN.

5 times	1—white worsted	2/36 back.
	1—grey mixture wstd.	2/36 face.
40 times	1—black worsted	2/36 back.
	1—grey mixture wstd.	2/36 face.
20 times	1—blue slate worsted	2/36 back.
	1—grey mixture wstd.	2/36 face.
40 times	1—white worsted	2/36 back.
	1—grey mixture wstd.	2/36 face.
5 times	1—black worsted	2/36 back.
	1—grey mixture wstd.	2/36 face.
40 times	1—white worsted	2/36 back
	1—grey mixture wstd.	2/36 face.
20 times	1—blue slate worsted	2/36 back.
	1—grey mixture wstd.	2/36 face.
40 times	1—black worsted	2/36 back.
	1—grey mixture wstd.	2/36 face.

420 threads in pattern.

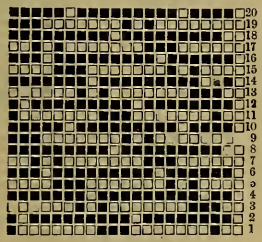
FILLING PATTERN.

5 times	1—white	4½ run, right twist.
	1—black	4½ run, right twist.
	80—black	4½ run, right twist.
20 times	1—blue slate	4½ run, right twist.
	1—black	4½ run, right twist.
40 times	1—white	4½ run, right twist.
	1—black	4½ run, right twist.
	10—black	4½ run, right twist.
40 times	1—white	4½ run, right twist.
	1—black	4½ run, right twist.
20 times	1—blue slate	4½ run, right twist.
	1—black	4½ run, right twist.
	80—black	4½ run, right twist.

420 picks to pattern

Face mixture is:
40% white fine worsted tops.
60% black slub dyed tops.

Weaving chain:
Straight draw on 20 harness.



FRONT.

COST CALCULATION.

2,940 ends 2/36s worsted mixture		
Plus 10% take-up	.46 oz.	
		5.12 oz.
2.940 ends 2/36s skein dyed	4.66 oz.	
Plus 10% take-up	.46 oz.	
		5.12 oz.
120 ends 2/36 listing	.19 oz.	
Plus 10% take-up	.02 oz.	
		.21 oz.
Filling:		
68⅓" × 100 picks = 6,830.		
6,830 ÷ 4½ runs	15.18 oz.	
Plus 10% take-up	1.51 oz.	
		16.69 oz.
Loom weight		27.14 oz.

Finished weight, 21½ to 22 oz.

5.12 oz. 2/36 worsted mixture + 2% waste allowance = 5.22 oz. @ $1.15 per lb	= $ .3752
5.12 oz. 2/36 worsted skein dyed + 6% waste allowance = 5.45 oz. @ $1.00 per lb	= .3406
.21 oz. 2/36 worsted listing + 2% waste allowance = .23 oz. @ $1.00 per lb	= .0014
Filling:	
16.69 oz. 4½ run filling + 10% waste allowance = 18.54 oz. @ 60c.	= .6952
Cost of material	$1.4124
Manufacturing charges	.7000
Mill cost	$2.1124

UNIFORM FABRICS—CADET GREYS

These fabrics are made usually in 14-ounce, 15-ounce, 16-ounce, 18-ounce, 21-ounce and 24-ounce cloths. The construction and cost calculations of the first four of these weights are given below. The cloth is used for uniforms for post offices, military and high schools, etc. It must be made from a strong good feeling wool, as it is required to pass a high test for strength and wearing qualities, hence care must be taken in selecting the stock and blending it to insure a thorough mixing and freedom from specks when carded.

The blue wool in the mixture must be indigo-dyed. Goods to be fulled with a good heavy-bodied soap to insure felting. Full to 56 inches inside listing. Scour, dry to 57 inches, shear face, steam and brush well and press heavy. Fulled in length to hold 14 per cent shrinkage when finished. All yarns are spun fully half draft, say, five-eighths draft.

14 Oz. CADET GREY UNIFORM CLOTH

Layout:
2,880 ends 11½/3 in dent, 83½" inside listing, plus 1" for listing = 84½" over all.
White yarn, 4 run.
40 picks.
6 harness. Listing, extra harnesses.

STRAIGHT DRAW.

Warp:
2,880 ends 4⅜ run, left twist..... 6.59 oz.
Plus 8% loom take-up..... .53 oz.

Filling:
40 picks × 84½" = 3,380.
3,380 4½ run filling, right twist.. 7.51 oz.
Plus 8% loom take-up..... .60 oz.

Loom weight .....15.23 oz.
Finished weight 14 oz.

COST CALCULATION.

Warp and filling yarns spun from same stock mixture.
50% fine A. A. pulled white @ 63c. ..... = $ .3100
50% fine Texas 12 mo. (indigo dyed, med. blue shade) @ 63c. ..... = .3150

16) $ .6250

An ounce .....$ .0390

Material:
15.23 oz. + 10% loom waste allowance = 16.92 oz.
Plus 14% shrinkage in length at fulling = 19.67 oz., stock required per finished yard.
19.67 oz. @ $.0390 per oz. ..... = $ .7680

Manufacturing:
40 picks @ $.0900 = $ .3600.
Plus 14% ..... = $ .4186

Mill cost $1.1866

It is possible to cut down this labor cost by having spinners run 2 mules and weavers run 2 looms each.

15 Oz. CADET GREY UNIFORM CLOTH.

Layout:
3,000 ends, 12/3 reed; 83⅓" inside listing, plus 1" for listing = 84⅓" over all.
White 4 run yarn.
42 picks.
Same yarns and weave as 14-oz. cloth.

Warp:
3,000 ends 4⅜ run warp, left twist ..... 6.86 oz.
Plus 8% loom take-up..... .55 oz.

Filling:
42 picks × 84⅓" = 3,542.
3,542 ÷ 4½ run filling, right twist ..... 7.86 oz.
Plus 8% loom take-up..... .63 oz.

Loom weight .....15.90 oz.

Finished weight, 15 oz.

COST CALCULATION.

Stock:
Same blend as the 14-oz. cloth @ $.0390 per oz.

Material:
15.90 oz. + 10% loom waste allowance = 17.66 oz.
Plus 16% shrinkage in length at fulling = 21 oz. stock required per finished yard.
21 oz. stock @ $.0390 per oz... = $ .8190

Manufacturing:
42 picks @ $.0890 = $.3696.
Plus 16% shrinkage ..... = .4400

Mill cost $1.2590

This labor cost can be cut down by spinners running 2 mules and weavers running 2 looms each.

16 Oz. CADET GREY UNIFORM CLOTH.

Layout:
3,000 ends 12/3 reed, 83⅓" inside listing, + 1" for listing = 84⅓" over all.
White yarn 3½ run.
44 picks.
Same weave as 14-oz. fabric.

Warp:
3,000 ends 4 run, left twist..... 7.50 oz.
Plus 8% loom take-up ..... .60 oz.
44 picks × 84⅓" = 3,,10.
3,710 ÷ 4½ run filling, right twist 8.24 oz.
Plus 8% loom take-up..... .66 oz.

Loom weight .....17.00 oz.

Finished weight, 16 oz.

COST CALCULATION.

Stock:
Same blend as the 14-oz. cloth = $.0390 per oz.
17 oz. + 10% loom waste allowance = 19 oz.
19 oz. + 16% shrinkage in length in fulling = 22.62 oz. stock required per finished yard.
22.62 oz. stock @ $.0390..... = $ .8821

Manufacturing:
44 picks @ $.0860 = $.3784.
Plus 16% shrinkage ..... = .4500

Mill cost $1.3321

This labor cost can be cut down by spinners running 2 mules and weavers running 2 looms each.

18 Oz. CADET GREY UNIFORM CLOTH.

Layout:

3,000 ends warp, 12/3 reed, 83⅓" inside listing, plus 1" for listing = 84⅓" over all.
White 3½ run yarn.
40 picks.

Weave:

8 harness.
2 harness extra for listing.

STRAIGHT DRAW.

Warp:

3,000 ends, 4 run warp, left twist. 7.50 oz.
Plus 10% loom take-up..... .75 oz.

Filling:

40 picks × 83⅓" = 3,374.
3,374 ÷ 3¼ run right twist.....10.38 oz.
Plus 8% take-up..... .80 oz.

Loom weight .....19.43 oz.

Finished weight, 18 oz.

COST CALCULATION.

Stock:

Same blend as the 14-oz. cloth = $.0390 per oz.
19.43 oz. loom weight, plus 10% waste allowance = 21.59 oz.
21.59 oz. + 16% shrinkage in length at fulling = 25.70 oz.

Manufacturing:

25.70 oz. @ $.0390 per oz..... = $1.0000
40 picks @ $.0900 = $.3600.
Plus 16% shrinkage ..... = .4285

Mill cost $1.4285

Both the 21-ounce and 24-ounce fabrics analyzed below are usually given a light run on the gig, using old or dull teasels, just enough gigging to straighten out the fibres of wool on face. Dry, shear close, steam brush and press hard.

21 Oz. CADET GREY UNIFORM CLOTH.

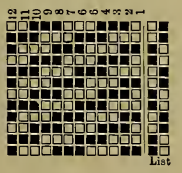
Layout:

4,400 ends, 13½/4 reed, 81½" inside listing, plus 1½" for listing = 83" over all.
White 3½ run yarn.
50 picks.

Weave:

12 harnesses.
2 harnesses extra for listing.

STRAIGHT DRAW.



Warp:

4,400 ends, 4 run, left twist.....11.00 oz.
Plus 10% loom take-up..... 1.10 oz.

Filling:

50 picks × 83" = 4,150.
4,150 ÷ 4½ run, right twist..... 9.22 oz.
Plus 10% loom take-up..... .92 oz.

Loom weight .....22.24 oz.

Finished weight .....21.00 oz.

COST CALCULATION.

Stock:

Same blend as the 14-oz. fabric @ $.0390 per oz.
22.24 oz., loom weight, plus 10% waste allowance = 24.66 oz.
24.66 oz. + 16% shrinkage at fulling = 29.35 oz.

Manufacturing:

29.35 oz. @ $.0390..... = $1.1446
50 picks @ $.0800 + 16%..... = .4760

Mill cost $1.6206

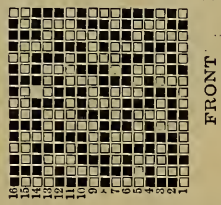
24 Oz. CADET GREY UNIFORM CLOTH.

Layout:

4,800 ends 14½/4 reed, 82¾" inside listing, plus 1½" for listing = 84¼" over all.
3½ run white yarn.
56 picks.

Weave:

12 harnesses as in 21-oz. cloth;
Or 16 harnesses straight draw, as below.



Warp:

4,800 ends 4 run warp, left twist..12.00 oz.
Plus 10% loom take-up..... 1.20 oz.

Filling:

56 picks × 84¼" = 4.718.
4,718 ÷ 4½ run right twist filling 11.80 oz.
Plus 8% take-up ..... = .95 oz.

Loom weight .....25.95 oz.

Finished weight, 24 oz.

COST CALCULATION.

Stock:

Same blend as 14-oz. fabric @ $.0390 per oz.

25.95 oz. loom weight, + 10% waste allowance = 28.3 oz.
28.3 oz. + 16% shrinkage in fulling = 33⅓ oz. stock required per finished yard.

Manufacturing:

33⅓ oz. @ $.0390 per oz..... = $1.2998
56 picks @ $.0740 = $.4144.
Plus 16% shrinkage ..... = .4933

Mill cost $1.7931

REGATTA STRIPE LADIES' SUITING

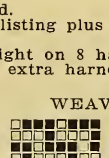
This cloth is woven on a double plain weave, the warp threads being a thread face and a thread back, while the filling threads show both on face and back, the white pick weaving on the face as it interlaces with the white warp threads, then goes on to the back where it interlaces with the grey threads. The grey filling thread works the opposite of the white thread. The stock used is a fine wool and carbonized white noil, free from nubs, and carded worsted yarn waste. Cards must be in good condition and great care must be taken to see that the grey stock is carded free from specks. Very little fulling is required. Extract, dry at 57 inches and press light.

10½-Ounce Regatta Stripe Ladies' Suiting.

Layout:

1,760 ends
12½/2 reed.
70" inside listing plus 1" for listing = 71" over all.
Draw straight on 8 harness.
Listing on extra harness or side straps.
30 picks.

WEAVE.



FRONT.

Warp:

3½ run yarn, right twist.

Filling:

3¾ run yarn, right twist.

WARP PATTERN.

4—White, 3½ run.
4—Light grey, 3½ run.
4—White, 3½ run.
2—Light grey, 3½ run.
2—Blue fancy, 5 run.
4—White, 3½ run.
4—Light grey, 3½ run.
4—White, 3½ run.
2—Light grey, 3½ run.
2—Black and white 2/40s cotton.

32 threads = 11 patts.; 5 sections.

FILLING PATTERN.

1--Light grey, 3¾ run.
1--White, 3¾ run.

COST CALCULATIONS.

Warp:

880 ends white warp, 3½ run = 2.51 oz. + 10% loom take-up =	2.76 oz.
660 ends light grey warp, 3½ run = 1.88 oz. + 10% loom take-up =	2.06 oz.
110 ends blue fancy, 5 run = 0.22 oz. + 10% loom take-up =	0.24 oz.
110 ends black and white 2/40s cotton = 0.11 oz. + 10% loom take-up	0.12 oz.

Filling.

71" × 30 picks = 2,130.	
1,065 picks white 3¾ run = 2.84 oz. + 10% loom take-up =	3.12 oz.
1,065 picks light grey 3¾ run = 2.84 oz. + 10% loom take-up =	3.12 oz.
Loom weight	11.42 oz.

Finished weight, 10.50 oz.

Stock for white yarns:

70% white noil @ 42c. =	$ .2940
30% white fine wool @ 55c. =	.1650
Cost per pound	$ .4590

Stock for light grey yarns:

40% white wool @ 55c. =	$ .2200
30% white noil @ 42c. =	.1260
30% fine black carded worsted waste @ 30c. =	.0900
Cost per pound	$ .4360

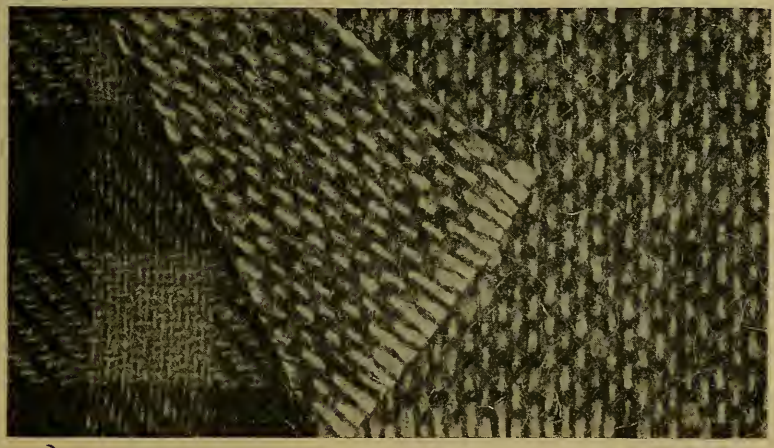
2.76 oz.	white warp.
3.12 oz.	white filling.
5.88 oz. + 6% waste allowance = 6.26 oz. @ $.4590 per lb. =	$ .1795
2.06 oz.	light grey warp.
3.12 oz.	light grey filling.
5.18 oz. + 6% waste allowance = 5.52 oz. @ $.4360 per lb. =	.1504
0.24 oz.	blue fancy + 6% waste allowance = 0.25 oz. @ $.6000 per lb. =	.0094
	2/40s twist cotton, black and white = 0.12 oz. @ $.4000 per lb. =	.0030
		$ .3423

Manufacturing cost:

30 picks at 1c.	.3000
Mill cost	$ .6423

PLAID BACK HOMESPUN CLOAKING

This fabric is woven with plain weave face and four-harness twill back with 1 thread heavy homespun nub yarn on face and 2 threads fine yarn on back. The face yarns are made from coarse imported wools, while the



22-Ounce Plaid Back Homespun Cloaking.

backing yarns are made from fine medium domestic wool, with a mixture of fine light shoddy for dyeing. Face yarn is spun heavy and rough carded, with a good percentage of large nubs. In spinning this homespun yarn a good long draft is required, say three-fourths draft, and medium twist,

with just enough to ensure good weaving. The filling is spun soft. Backing yarn should be a good level thread free from twists and bunches, draft to be five-eighths of mule. Full very slightly, but give a good scouring, running the goods a little extra in the soap. Rinse well, extract and dry at 58 inches. Shear back and give medium pressure. Finish at 54 to 55 inches inside.

Layout:
1,280 ends 3 run back warp.
640 ends 1 run face warp.
320 ends 2/40s cotton binder.

2,240 ends.

Reed 7 $\frac{1}{5}$ $\frac{1}{4}$ $\frac{1}{5}$ = 68¾" inside listing.

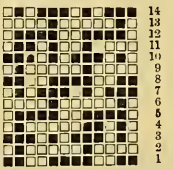
1¼" listing.

70" over all.

Weave:
Draw straight on 14 harness.

Twice.
1. Light tan, 3 run.
1. White nub yarn, 1 run.
1. Light tan, 3 run.
1. Drab cotton, 2/40.
1. Light tan, 3 run.
1. White nub yarn, 1 run.
2. Light tan, 3 run.
1. White nub yarn, 1 run.
1. Light tan, 3 run.
1. Drab cotton, 2/40.
1. Light tan, 3 run.
1. White nub yarn, 1 run.
1. Light tan, 3 run.

56 threads in pattern.



One dent. 2/40s cotton binder.
" 2/40s cotton binder.
"

FILLING PATTERN.

8 times.
1. Olive green, 3 run.
1. Medium brown nub yarn, 1 run.
1. Olive green, 3 run.
1. Light tan, 3 run.
1. Med. brown nub yarn, 1 run.
1. Light tan, 3 run.

48 threads in pattern.
36 picks per inch.

FRONT.

This chain is made to weave face down.

Stock for face warp:

15% large white nub @ 50c.	$ .0750
20% white med. wool @ 44c.	.0880
65% white Kandahar @ 32c.	.2080
Cost per pound	$ .3710

Stock for backing:

50% fine med. wool @ 56c.	$ .2800
50% fine shoddy @ 24c.	.1200
Light shades for coloring.	
Cost per pound	$ .4000

Stock for face filling:

15% nubs @ 50c.	$ .0750
20% med. wool @ 44c.	.0880
20% E. India wool @ 25c.	.0500
45% coarse shoddy @ 15c.	.0675
Cost per pound	$ .2805

2/40s dyed cotton yarn @ 48c. per pound.

WARP PATTERN.

Twice.
1. Olive green, 3 run.
1. White nub yarn, 1 run.
1. Olive green, 3 run.
1. Drab cotton yarn, 2/40.
1. Olive green, 3 run.
1. White nub yarn, 1 run.
2. Olive green, 3 run.
1. White nub yarn, 1 run.
1. Olive green, 3 run.
1. Drab cotton, 2/40.
1. Olive green, 3 run.
1. White nub yarn, 1 run.
1. Olive green, 3 run.

COST CALCULATIONS.

Warp:

1,280 ends, 3 run = 4.27 oz., plus 10% take-up	= 4.70 oz.
640 ends, 1 run = 6.40 oz., plus 10% take-up	= 7.04 oz.
320 ends 2/40s = 0.32 oz., plus 10% take-up	= 0.35 oz.

Filling:

70" × 36 picks = 2,520.

1,680 threads, 3 run = 5.60 oz., plus 10% take-up	= 6.16 oz.
840 threads, 1 run = 8.40 oz., plus 10% take-up	= 9.24 oz.
Loom weight	27.49 oz.

Finished weight, 22 oz.

7.04 oz.	face warp plus 15% waste allowance = 8.28 oz. @ $.3710 per lb.	= $ .1920
9.24 oz.	face filling plus 20% waste allowance = 11.55 oz. @ $.2800 per lb.	= .2021
4.70 oz.	back warp.	
6.16 oz.	back filling.	
10.86 oz.	plus 15% waste allowance = 12.77 oz. @ $.4000 per lb.	= .3192
.035 oz.	2/40s drab cotton binder @ $.3500 @ $.4800 per lb.	= .0105
	Cost of stock	$ .7238

Manufacturing:

36 picks @ $.0094	.3384
Mill cost	$1.0622

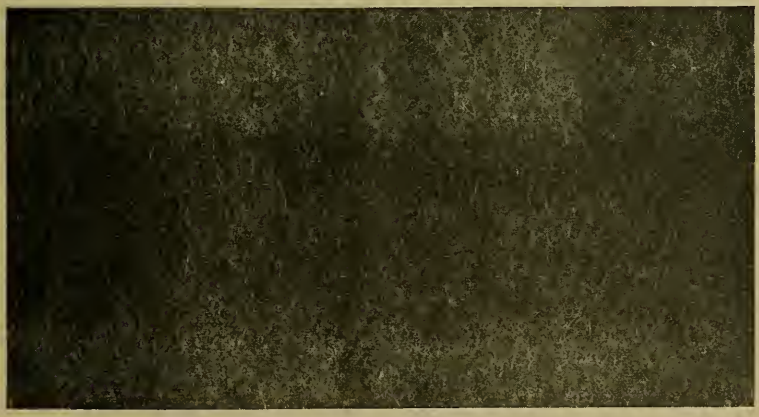
MACKINAW FABRICS

For many years this fabric was practically monopolized by the lumber men and hunters in the Michigan woods, and recently became much in vogue with college men and others who are fond of out-door life, for which it is especially adapted. It is also used for winter sports when put through a waterproofing process. It is made in various weights from 22 to 32 ounces and upward, and in a great variety of fancy plaids in grey tones, also in fancy colors in strong contrasting shades and striking patterns. The fabric here illustrated is a 22-ounce cloth, and woven so as to feel thick and heavy, giving warmth without excessive weight. A low grade of mackinaws is also made with a cotton warp and all-shoddy or card waste fillings.

In spinning yarns for these fabrics it is necessary to have at least ¾-draft. Warp yarns are spun with just twist enough to ensure good weaving, and filling yarns are given a medium twist. Full to 56 inches inside listing, so as to hold loom length when finished. Scour, extract, nap both back and face, dry at 57 inches, brush and press with medium pressure.

Waterproofing Process.

If it is desired to waterproof this cloth, make up a soap solution in the proportion of 2½ ounces of good tallow soap in 5 gallons of water. A second solution of 3 ounces of alum in 5 gallons of water is also made up. Run the goods in the washer (after being scoured and rinsed off, and previous to the napping) in the soap solution until thoroughly saturated. Drain off the excess liquor, add the alum solution, and run goods as before until saturated, then drain off again, but do not rinse. Extract the same as regular goods. The alum solution precipitates the soap in the goods into an insoluble aluminate soap, and makes an excellent water repellent.



22-Ounce Mackinaw.

Layout:
2,000 ends.
Reed 7½/4.
66 2-3" inside listing.
1 1-3" for listing.

68" over all.
Draw straight on 6 harness.
Warp yarn:
1½ run, right twist.

Filling yarn:
1½ run, right twist.
30 picks.

FRONT.

WARP PATTERN.

12—Black.
18—Light grey mixture.
2—Black.
6—Light grey mixture.
8—Black.
8—Light grey mixture.
8—Black.
6—Light grey mixture.
2—Black.
18—Light grey mixture.
12—Black.

100 ends; 4 patterns; 5 sections.

FILLING PATTERN.

22—Black.
20—Light grey mixture.
2—Black.
4—Light grey mixture.
6—Black.
4—Light grey mixture.
6—Black.
4—Light grey mixture.
2—Black.
20—Light grey mixture.

90

STOCK BLEND, WARP AND FILLING.

Black:
50% coarse wool, black @ 36c.... $ .1800
50% coarse shoddy, black @ 15c.. .0750

Cost per pound ..... $ .2550

Light grey mixture:
30% coarse wool, white @ 40c..... $ .1200
35% coarse shoddy, white @ 25c.. .0875
35% coarse shoddy, black @ 15c.. .0525

Cost per pound ..... $ .2600

COST CALCULATIONS.

2,000 ends warp 1½ run = 13.33 oz. + 10% loom take-up....= 14.66 oz.

Filling:
68" × 30 picks = 2,040.
2,040 filling, 1½ run = 1,360 oz. + 10% loom take-up .....= 14.96 oz.

Loom weight ..... 29.62 oz.

Finished weight, 22 oz.

Warp:
880 ends black = 5.86 oz. + 10% loom take-up + 15% waste..= 7.57 oz.
1,120 threads light grey mixture = 7.46 oz. + 10% loom take-up + 15% waste .....= 9.66 oz.

Filling:
860 ends black = 5.74 oz. + 10% loom take-up + 15% waste..= 7.42 oz.
1,180 ends light grey mixture = 7.86 oz. + 10% loom take-up + 15% waste .....= 10.16 oz.
7.57 oz. black warp.
7.42 oz. black filling.

14.99 oz. @ $.2550 per lb.....= $ .2389

9.66 oz. light gray warp.
10.16 oz. light gray filling.

19.82 oz. @ 26c. per lb.....= $ .3220

$ .5609

Manufacturing cost:
30 picks @ 1c.....= $ .3000

Mill cost ..... $ .8609

LADIES' SUITING

12-Ounce Nub, Napped Finish.

These goods are made from Joria and Khorassan imported wools, with a percentage of good shoddy or mill waste. They are made in a large variety of colorings and designs, such as 1 x 1 hair line, 3 x 1 hair line, as in illustration, and 2 x 2 Regatta stripe, and in various broken stripes. These stripe patterns, made with the coarse rough yarns and finish, are very popular in England at present. The large "nubs" or rather "slugs" in this cloth enhance its appearance and value. The picks per inch being low, it is possible for a mill to get off a very large production. The nubs or slugs are made from a fine medium wool, and as large as possible on nubbing card, so when mixed with the batch and going through the carding operation, the large slugs are caught by the workers and drawn out in length. These slugs have to be felted or fulled a little before being added to the batch in the picker room. Yarns are spun a good fair twist, both for warp and filling, and about 2-3-draft is required. Full to 56 inches, inside listing, and hold loom length when finished. Nap slightly after extracting, dry at 57 inches, brush and press medium pressure.

Layout:
1,116 ends.

Warp:
1¾ run, right twist.

Filling:
1¾ run, right twist.
20 picks.

Reed—8.2 in dent = 69¾" inside listing.
1 " listing.
70¾" over all.

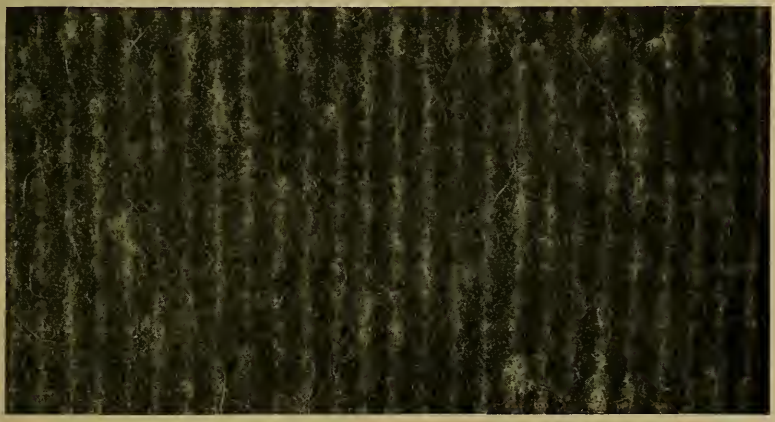
Straight draw on 6 harness.
2 listing.

WEAVE.

FRONT.

Warp pattern:
2 black 1¾ yarn.
1 white nub yarn.

Filling Pattern:
1 white nub yarn.
2 black nub yarn.



12-Ounce Dress Goods Suiting, 3 x 1 Hair Line.

STOCK BLEND WARP AND FILLING.

Black—35%	East India or Khorassan 30c. .....=	$ .1050
65%	Black serge shoddy 12c. .....=	.0780
	Cost per lb.....	$ .1830
White—15%	Large white nubs @ 60c. .....=	$ .0900
35%	White Joria wove @ 40c. .....=	.1400
50%	White coarse shoddy @ 30c.....=	.1500
	Cost per lb.....	$ .3800

COST CALCULATION.

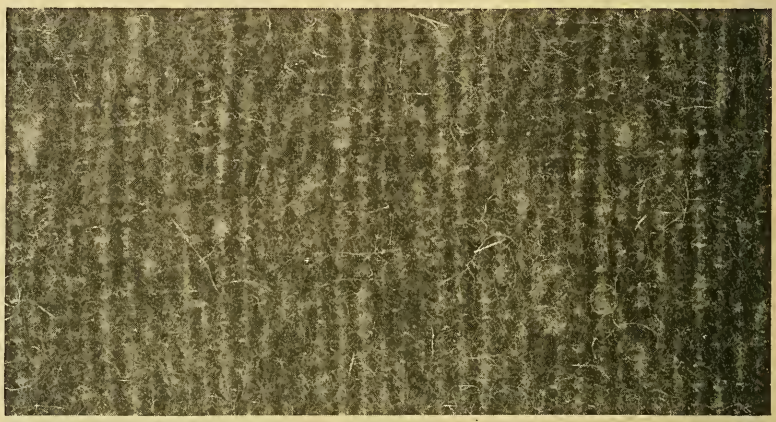
1,116 ends wp., 1¾ run = 6.37 oz. + 10% loom take-up.....=	7.00 oz.
70¾" × 20 picks = 1,414.	
14.14 ÷ 1¾ run = 8.08 oz. + 10% loom take-up .....=	8.88
Loom weight	15.88 oz.
Finished weight	12 oz.
4.66 oz. black warp yarn.	
5.92 oz. black filling yarn.	
10.58 oz. + 15% waste allowance = 12.4 oz. @ 18.3c. per lb.....=	$ .1418
2.33 oz. white nub warp.	
2.96 oz. white nub filling.	
5.29 oz. + 15% waste allowance = 6.2 oz. @ 38c. per lb.....=	.1472
	$ .2890

Manufacturing cost:

20 picks @ 1.10c.....=	$ .2200
Mill cost	$ .5090

Dress Goods Suiting, With Broken Stripe Effect.

Here is another illustration of same fabric and yarns but in one of the broken stripe effects. This style will cost a trifle more for stock, as there is a larger percentage of white yarns in the pattern.

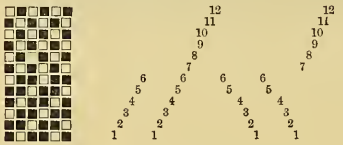


12-Ounce Dress Goods Suiting With B roken Stripe Effect.

Layout:
1,116 ends, 1¾ run warp and filling.
8 reed, 2 in dent 69¾" wide.
1" listing.

70¾" over all.

DRAFT.



FRONT.

COST CALCULATIONS.

3.50 oz. black warp. 4.44 oz. black filling.	
7.94 oz. + 15% waste allowance = 9.3 oz. @ 18.3c. per lb.....	= $ .1063
3.50 oz. white nub warp. 4.44 oz. white nub filling.	
7.94 oz. + 15% waste allowance = 9.3 oz. @ 38c. per lb.....	= .2209
	$ .3272
Manufacturing cost:	
20 picks @ 1.10c.....	= $ .2200
Mill cost	$ .5472

ASTRACHAN CLOAKING

26½ Ounce, Fancy Weave.

The illustrations accompanying this layout and calculations are photographic reproductions of the raw cloth (unfinished) which shows both the face and the back of the cloth to give a better understanding of how the weave in combination with the yarns are interwoven to give the wave twill effect. You will observe the small straight twill on face is gradually enlarged to a broad twill, showing loops of the lustre worsted yarn, which will, on being fulled, curl up in loops or bunches. This cloth must be made with comparatively few ends and set open in the reed, which gives the lustre yarn a chance to curl in the process of fulling. The small straight twill is formed by the finer warp yarn being set close in the reed, while the

coarser warp yarns are set open, which makes the twill large and wide. The construction is quite ingenious, and a novelty in cloth fabrication. The same care must be used in the finishing of this fabric as in the Ratiné cloaking, and although this cloth construction is not so liable to have mill wrinkles, the filling must be watched closely to prevent any such possibility. Full to 56 inches; scour, extract; piece dye to shade; dry to 57 inches; brush and shear off any coarse hairs on back, no pressing being required. Goods are finished loom length.

Layout:
1,800 ends warp

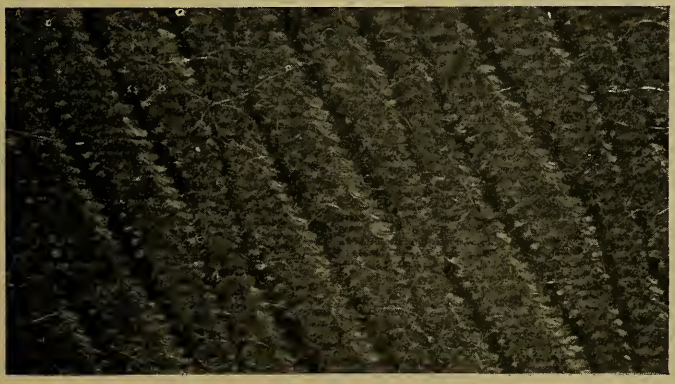
Dressed:
20 ends, 2 run, left twist. Medium.
16 " 4 " " " Hard.—Must be strong yarn.

36 ends, 10 patterns, 5 sections.
1,000 ends, 2 run, wp. left.
800 " 4 " " "

Reed 5, $\frac{1}{4}\ \frac{1}{4}\ \frac{1}{4}\ \frac{1}{4}\ \frac{1}{4}\ \frac{1}{4}\ \frac{1}{8}\ \frac{1}{8}$ 70 inches.

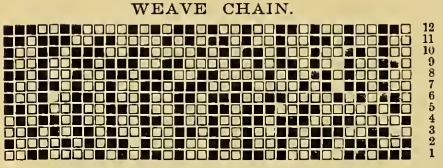
Filling pattern:
1 pick, 3s lustre worsted, soft spun left.
2 picks, 2 run, woolen, soft spun left.
48 picks.
Draw straight on 12 harness.

Face.



Back.

WEAVE CHAIN.



Warp calculations:

1,000 ends, 2 run = 5.00 oz. + 10% loom take-up.....	=	5.50 oz.
800 ends, 4 run = 2.00 oz. + 10% loom take-up.....	=	2.20 oz.

Filling:

70 inches × 48 picks = 3,360. 1,120 Threads 3s lustre = 10.66 oz. + 10% loom take-up..	=	11.72 oz.
2,240 Threads, 2 run wool = 11.20 oz. + 10% loom take-up	=	12.32 oz.
Loom weight		31.74 oz.
Finished weight		26½ oz.

Stock:

Blend for 2-run yarns.

40% Fine medium wool @ 56c.	=	$ .2240
60% Fine shoddy @ 18c.....	=	.1080
Cost per lb.....		$ .3320

Stock:

Blend for 4-run yarn.

70% Fine medium wool @ 56c.	=	$ .3920
30% Fine shoddy @ 18c.....	=	.0540
Cost per lb.....		$ .4460

3s Lustre Worsted Yarn, made from imported English Lincoln wool, 70c.

COST CALCULATIONS.

Warp:

5.50 oz. 2-run yarn + 15% waste allowance = 6.47 oz. @ 33.20c. per lb.....	=	$ .1342
2.20 oz. 4-run yarn + 10% waste allowance = 2.44 oz. @ 44.60c. per lb.....	=	.0680

Filling:

12.32 oz. 2-run yarn + 15% waste allowance = 14.50 oz. @ 32.20c. per lb.....	=	$ .2980
11.72 oz. 3s worsted + 5% waste allowance = 12.32 oz. @ 70c. per lb.....	=	.5390
		$1.0392

Manufacturing costs:

48 picks @ .82c.....	=	$ .3936
Less cost of manufacturing 12.32 oz. of yarn.....	=	.0300
		.3636
Mill cost		$1.4028

COTTON WARP ASTRACHAN CLOAKING

The most expensive astrachans are woven on a wire loom, which is similar to a carpet loom. Two warp beams are required, (1) for the lustre loop yarn and (1) for the body warp, which is usually cotton yarn. The loop or curl yarn is looped on the face of the cloth, being stitched into the body fabric about every half inch. The cheapest astrachan cloth made is what is known as the knitted astrachan. It is made usually with an all-cotton yarn ground with the lustre yarn looped on the face. This makes quite an attractive fabric to any who are not experienced in handling such goods, but it does not make up so satisfactorily into garments as the woven fabric. The knit fabric is sleazy and will not keep its shape when made up. It is also open in construction, light in weight, and lacking in warmth. The fabric here analyzed is the woven astrachan, made on a regular broad woolen loom, the ground weave being the regular 3-harness twill, 2 up and 1 down, throwing the woolen filling to the back of the cloth, while the lustre loop yarn is thrown to the face in a succession of loops.

The ground pick floats over 1 thread and under 2 threads, while the lustre yarn floats over 11 ground threads, and binding with seven other ground threads, every alternate loop covering the place where the previous pick of loop yarn was bound. The ground filling yarn is spun heavy with a medium soft twist to right, and a long draft is necessary, about ⅝ to ¾, it depending a good deal on the stock used. The lustre yarn thread, No. 3s worsted, is twisted with a 2-run woolen yarn, spun soft to the right, and when twisted with the lustre yarn the twist is con-

tinued to the right, 3 to 4 turns per inch. This hardens the woolen yarn twist and practically takes out all the original twist of the lustre yarn. The lustre yarn is allowed to run without any tension on the thread, and if the twister machine has 2 sets of feed rolls arranged with different speeds it is better to have the lustre yarn fed a trifle faster than the woolen or core yarn, which gives it a slight curl effect before weaving.

The cloth should be crabbed well before being scoured in soap. Give a good scouring and use plenty of warm water when rinsing off. Finish at 56 inches wide, no pressing being required. Cloth will finish longer than woven cotton yarn.

Layout:

2,240 ends 2/20.
Reed 11—3, 68 inches, 40 picks.
Draw straight on 18 harness.

Stock for 2-run twisting yarn:

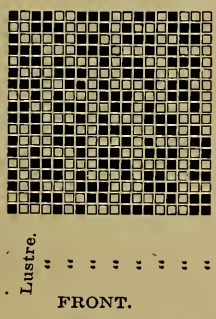
20% Fine medium wool @ 48c.	=	$ .0960
80% Good clean mill waste @ 12c.	=	.0960
Cost per lb		$ .1920

Stock for body filling:

Clean mill waste @ 12c. per lb.
Lustre yarn 3s worsted @ 72c. per lb.
Spooled for twisting.

Filling:

1 pick, 1⅛ woolen yarn, soft twist right.
1 " { 3s lustre worsted, left twist. Twisted 3-4 turns per inch to right with 2-run yarn; right twist soft.



FRONT.

COST CALCULATIONS.

2,240 ends 2/20 cotton yarn = 4.48 oz. + 10% loom take-up	=	4.92 oz.
3s lustre + 8% twist take-up. = 14.11 oz. + 10% loom take-up	=	15.52 oz.
2-run yarn + 10% twist take-up = 7.77 oz. + 10% loom take-up	=	8.54 oz.
1,360 ends 1⅛ body filling = 12.08 oz. + 10% loom take-up	=	13.28 oz.
Loom weight		42.26 oz.
Finished weight, 32 or 33 oz.		
4.92 oz. 2/20s cotton yarn on spools @ 30c. per lb	=	$ .0922
15.52 oz. lustre yarn + 6% twisting and weaving waste = 16.51 oz. @ 72c. per lb	=	.7428
8.54 oz. 2-run twisting + 18% waste allowance = 10.41 oz. @ 19.20c. per lb	=	.1249
13.28 oz. 1⅛ filling + 20% waste allowance = 16.60 oz. @ 12c. per lb.	=	.1245
Manufacturing cost		$1.0846
40 picks @ .90c	=	.3600
Mill cost		$1.4446

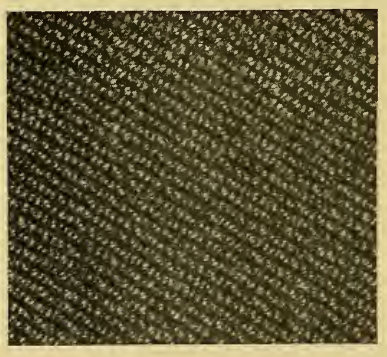
No allowance is made for extra cost of twisting face yarns, as it will be offset by the fact that the warp yarn, 4.48 ounces, and the lustre yarn, 16½ ounces, are bought ready for use, hence the mill is relieved of the cost of carding and spinning these yarns.

Dyeing Particulars.

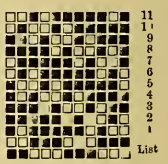
As these filling (woolen) yarns are made from mill waste which may contain a more or less percentage of cotton, it is necessary to dye the pieces with a good union black dye. The dyestuff used in Philadelphia with great satisfaction is Union Black A. N. For 100 pounds of goods dyed in the piece use a solution containing 5 per cent Union Black A. N., ten per cent common salt, and 10 per cent Glauber's salt. Enter at low temperature, bring slowly to a boil, and boil for forty minutes. Shut off the steam and run for thirty minutes longer, then rinse well.

HEAVY-WEIGHT WHIPCORD

This is a cloth used a great deal for riding breeches, and other usages requiring a strong, hard-faced and flexible cloth; that is, a cloth which is elastic, and yet firm at the same time. The twist yarn requires the best of wool to ensure evenness and freedom from nubs or specks. The yarn must be smooth and the wool thoroughly clean and carefully prepared. Care should be taken to see that the cards are in good condition and doffers not running too fast. Spin five-eighth draft and medium twist. This fabric is fulled to 57 inches. Scour, dry, shear, steam, brush and press medium. Hold loom length.



26-Ounce Heavy-Weight Whipcord.



FRONT.

Warp:
4,400 ends.
1 1
11½ — — in dent.
6 5
69½" inside listing plus 1" for listing = 70½" over all.
White, 5 run; twist 22 times.
48 picks.
3½ run, left twist.

Warp yarn:
5 run dark olive brown, left twist.
5½ run white, left twist.
Yarn is twisted right on twister, 22 turns per inch.
Straight draw on 11 harness.
2 extra for listing.

Warp yarn:
5 × 5½ twisted + 8% take-up = 2.42 run.
4,400 ends 2.42 run = 18.20 oz.
plus 10% take-up .....= 20.00 oz.

Filling:
70½" × 48 picks = 3½ run yarn.
3,384 ÷ 3.50 = 9.66 oz. plus 10% take-up .....= 10.60 oz.

Loom weight .....= 30.60 oz.
Finished weight .....= 26.00 oz.

COST CALCULATION.

Material:
Warp:
Fine wool @ 66c. per lb.
20 oz. twist yarn + 10% waste allowance .....= 22.00 oz.
Filling:
Fine medium Terr. @ 56c. per lb.
10.6 oz. + 8% waste allowance.= 11.50 oz.
22 oz. warp @ 66c. per lb..... = $ .9025
11.5 oz. filling @ 56c. per lb... = .4025

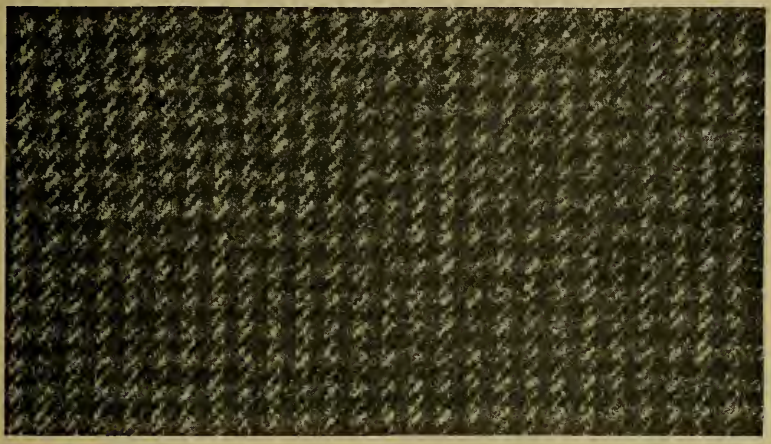
Cost of stock $1.3050
Manufacturing cost:
48 picks @ $.0082 .....= .3936
Extra spooling twisting warp yarn 5c. per lb.; 22 oz. at 5c..... .0700

Mill cost ..... $ .1.7686

FINE QUALITY (MEN'S WEAR) SUITING

This fabric is made from fine wools, combined with a 2-32s two-tone worsted twist. The woolen spun yarns require careful carding and spinning. Yarns must be level and free from twits. Warp yarn is spun with 1,050 to 1,080 turns of twist, and filling yarn with 950 to 975 turns. The draft is ½s to ⅝s. Goods are fulled to 56 inches inside listing, and fin-

ished woven length. Scour, extract, dry at 57 inches and back burl. Shear, steam brush, press medium pressure, giving goods a little steam, and keep on roll over night.



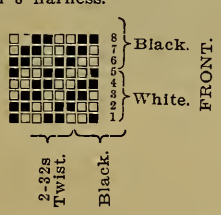
12½-Ounce Fine Quality Men's Wear Suiting.

Layout:
3,200 ends.
11½/4.
69½" inside listing.
1" for listing.

70½" over all.

Warp pattern:
4—White 5 run, right twist.
4—Grey mix, 5 run, right twist.

Filling pattern:
4—Black 5¼ run, right twist.
4—Black and stain 2/32s worsted.
Weave 4 harness, twill to right.
54 picks.
Draw on 8 harness.



The grey mix in the warp is made as follows:
5% navy blue fine wool @ 60c.
45% black fine wool @ 60c.
15% light stain (pearl) fine wool @ 60c.
35% white fine wool @ 60c.

100%

The stain color in the 2/32s worsted twist is the same shade as the light stain (pearl) in the grey mixture, and is slub dyed.

COST CALCULATIONS.

Warp:
3,200 ends ÷ 5 run = 6.44 oz. + 10% loom take-up .....= 7.08 oz.

Filling:
70½" × 54 picks = 3,800.
1,900 threads ÷ 5½ run = 3.62 oz. + 10% loom take-up.....= 3.98 oz.
1,900 threads 2/32s + 6% take-up in twisting.
2/30s = 3.62 oz. + 10% loom take-up .....= 3.98 oz.

Loom weight .....15.04 oz.

Finished weight, 12½ oz.

Warp:
7.08 oz. + 8% waste allowance = 7.70 oz. @ 60c. per lb.....= $ .2887

Filling:
3.98 oz. + 8% waste allowance = 4.22 oz. @ 60c. per lb.....= .1583
3.98 oz. worsted + 3% waste allowance = 4.10 oz. @ $1.20 per lb. .....= .3075

$ .7545

Manufacturing:
54 picks @ $.0076 .....= .4104

Mill cost $1.1649

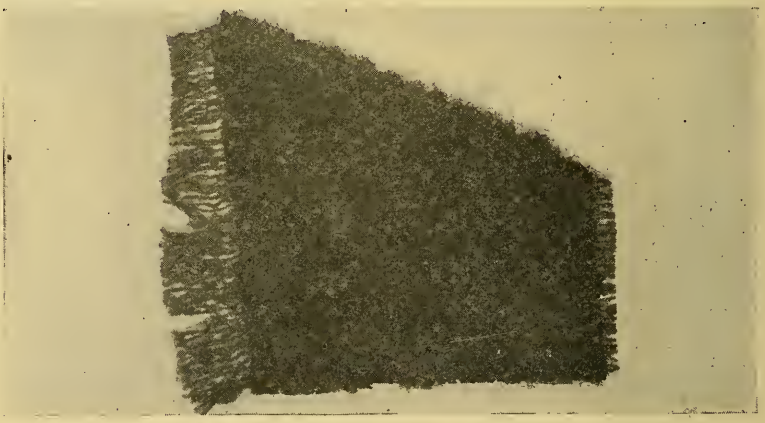
DRESS GOODS SUITING

12½-Ounce, Worsted Loop Filling.

This fabric is made somewhat after the idea of a Ratiné cloth. The warp yarn is made from a medium quality of wool, combined with a quarter-blood carbonized noil. It is woven with white warp and black loop yarn dyed fast acid black to stand cross dyeing. Then the white warp can be dyed into any desired shade, giving a handsome line of ground colors, all with the black loop filling. It is also made with all white stock, warp and filling, and dyed any desired shade in monotone, giving a very rich pebbled cloth, suitable for the finest trade. This worsted loop may be used also in fancy patterns, such as 1 x 1 hair lines, 2 x 2 Regatta stripes, and various broken stripes and plaids, in the ground pattern. The fabric may, therefore, be classed as a semi-piece dye, plain and fancy, also as a regular piece dye fabric. The warp yarn is spun to three run, well twisted, and must be even and free from twits, as the plain weave is always hard on the warp yarn, and any broken ends, or short ends out, must be sewed in, hence the necessity of good strong yarn.

Filling Yarn.

The worsted filling yarn is a three-ply twist, necessitating two twisting operations and twisting machines having two sets of feed rolls arranged with variable speeds. The 12s lustre yarn, soft spun, left twist, is twisted first with a 2-32s quarter-blood worsted right twist. These threads are twisted together about 10 turns per inch, right twist. The



12½-Ounce Dress Goods Suiting.

feed rolls conveying the 12s yarn are speeded to run about 50 per cent faster than the rolls conveying the 2-32s yarn, which makes a continuous kinky or curly effect on the yarn.

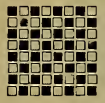
This yarn is not suitable for weaving at this stage, as the loop would slip on the base thread, hence it is necessary to twist it the second time, reversing the twist, that is, to the left, about six turns per inch, with the 16s single worsted, which will hold the loops tight on the base yarn. Between the first and second twisting the yarns are thoroughly steamed.

You will notice in the first twisting that the original twist is taken out of the 12s lustre yarn, which opens the thread and makes it fuzzy at the loop, while the twist is continued or hardened on the 2-32s yarn. In the second twisting the twist of the 2-32s yarn is taken out, and the twist of the 16s single yarn is continued or hardened.

This yarn construction may be cheapened by using a twist cotton yarn for the base instead of the worsted. Any manufacturer not equipped with the necessary twisters can buy the yarn already to weave. In burling this cloth all knots must be pulled through to the back, but not cut off until the cloth is ready to shear. If the knots were cut off previous to fulling and scouring, the ends would shrink just enough to cause a small pin-head hole in every case. After the goods are dyed and dry, the knots can be cut off by the shear, care being taken to raise the blades enough not to cut off the worsted pebbled effect. Give very slight fulling without any cramping. Scour, extract, and piece dye to shade. Dry at 57 inches, press lightly, and steam off face to lift the worsted loops.

Layout:

1,120 ends.
8½—2 reed.
66" inside listing plus 1" for listing = 67' over all.
20 picks.
Plain cloth weave.
Draw straight on 8 harness.



Warp:

25% fine med. wool @ 48c. =	$ .1200
75% med. carb. noil @ 40c. =	.3000
Cost per pound.	$ .4200

12s lustre worsted	75c. per lb.
2/32s ¼ blood worsted	87c. per lb.
16s ¼ blood worsted	80c. per lb.
67" × 20 picks = 1,340.	
1,340 threads 12s = 3.19 oz. + 50% twisting take-up = 4.78 oz. + 10% weaving take-up. =	5.26 oz.
1,340 threads 2/32s = 2.39 oz. + 15% twisting take-up = 2.74 oz. + 10% weaving take-up. =	3.01 oz.
1,340 threads 16s = 2.39 oz. + 20% twisting take-up = 2.86 oz. + 10% weaving take-up. =	3.14 oz.
1,120 ends warp 3 run + 10% take-up + 10% waste allowance = 4.40 oz. @ 42c. per lb. =	$.1155
5.26 oz. 12s worsted + 6% waste allowance = 5.60 oz. @ 75c. per lb. =	.2625
3.01 oz. 2/32s worsted + 3% waste allowance = 3.11 oz. @ 87c. per lb. =	.1700
3.14 oz. 16s worsted + 3% waste allowance = 3.24 oz. @ 80c. per lb. =	.1620
Manufacturing cost	$ .7100
20 picks @ $.1100 =	.2200
Extra cost (twisting) =	.0250
Mill cost	$.9550

Loom weight, 16 oz.
Finished weight, 12½ oz.

HOMESPUN FABRICS

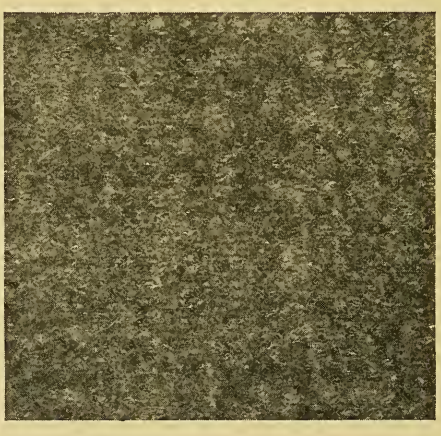
The name homespun is applied to a number of different fabrics, usually any cloth made from coarse kempy wools, heavy yarns or plain cloth weave with a rough finish. The real genuine homespun, however, is a rare fabric to find in the market, but there are many good imitations, and the fabric here illustrated is one of the best of them. As its name implies, the homespun is a cloth made up in the homes, where the wool is carded, yarns are spun and cloth is woven, every operation being done by hand labor. The process of carding and spinning by hand is a very ancient one, and dates away back into the mists of antiquity. In comparatively modern times our grandmothers carded the home-grown wools by hand cards, which were made out of a piece of hard wood about a quarter of an inch thick and 14 inches long by five inches wide, having a handle in the centre. This hand card was covered with a piece of card cloth, also made by hand labor in

the early days, but about a century ago an automatic card clothing machine was invented.

Carding Process.

The carding was done by placing a small bunch of wool on the card held by the left hand, and drawing the other card across it against the points of the wire by reversing the draw, that is, by pulling with the slant of the wire the wool was stripped off. Hence, hand carding was a process of combing or carding with the points of the wire on the cards opposed to each other, repeating the stroke over and over again, in order to mix or blend the fibre and colors into a satisfactory mixture. Then, by reversing the card, the wool was stripped off into a small roll about half to five-eighths of an inch in diameter and about 14 inches long.

This roll was then placed on the spinning wheel and, by a process which is impossible to describe, the roll was drawn out and spun into a thread of yarn. Then came the dressing of the warp and the weaving of the cloth. Needless to say the work was hard and laborious, and, except in very exceptional cases of skillful handling, the product was uneven in the mixture, and the cloth was raw and coarse in texture.



12-Ounce Homespun Fabric.

After the introduction of carding machines very few farmers did their own carding, but sent the wool to the custom carding mills, which made the rolls on a machine at the rate of 50 or 60 per minute, at a cost of a few cents per pound to the farmer. The spinning and weaving was still done at the homes by the wives and daughters. Such was the method of manufacturing in the olden times, and it is so done to-day in remote districts in Quebec and the Maritime provinces.

Modern Results Too Perfect.

The modern manufacturer, when he attempts to make a homespun fabric, generally gets the work too perfect in the weaving or blending of the different colors, and the cloth lacks the mottled uneven appearance of the genuine homespun. In making the homespun here illustrated, the manufacturer aimed to follow or imitate the primitive methods, as far as possible, and use the modern machinery. Therefore, the wool in this case was natural sheep brown for the dark shade, 40 per cent, and white wool, 60 per cent. The two colors were oiled and picked separately, each color being run through the picker twice, then spread carefully in thin layers, first a layer of white

wool, then a layer of natural sheep brown, and so on in alternate layers, until the whole batch was laid down in a pile.

The batch was then run through the picker once, care being taken to cut the pile from top to bottom to get as even a blend as possible. In carding a Bramwell feed was used, and the side drawing from the first breaker card was carried over the second carding cylinder to the finisher card by an Apperly carrier. The workers on both breaker and finisher cards were set open, so that the stock would not be mixed and carded too much. Just enough carding was done to condense the wool into roping sufficient to insure a good production in the spinning room. If one had an old creel feed and on an Apperly it would be an improvement. There is no chance to use shoddy in this fabric, as all stock must be of good staple wool. The yarn was spun to two and one-quarter run warp, right twist and two and one-half run filling right twist, about five-eighths draft being allowed. The following are a few of the most popular homespun mixtures as made in Scotland:

40% natural sheep brown.
60% white wool.

30% olive dyed wool.
70% white.

60% seal brown.
40% white.

10% black wool.
10% light blue stain.
80% white.

25% black.
75% white.

20% yellow drab.
20% lavender slate.
60% medium dark brown.

20% dark cerulean green.
20% light red brown.
15% seal brown.
45% white.

Also the Lovat mixtures:

11% light indigo blue.
25% dark yellow drab.
9% yellow brown.
25% light red or cinnamon color.
25% chrome yellow.
5% white.

38% light indigo blue.
22% chrome yellow.
12% white.
16% bright yellow.
12% yellow brown.

Blending Done Successfully.

Scotch manufacturers have used with great success in homespuns, especially in dress goods, or materials with rough effects, a percentage of camels hair tops, also mohair and alpaca wools. These blends were very attractive, the mohair combinations especially showing up lustrous and silky. The weaves generally used are the plain cloth to finish 10 ounces to 12 ounces, and the four harness twill weave for goods to finish 12 ounces to 14 ounces per yard, 56 inches wide. Handsome patterns are made in 1x1, 2x2 warps and fillings, using contrasted shades in both weaves.

The goods are laid not over 68 inches wide in the reed and scoured before fulling, very little of the latter being required. Dry at 57 inches, shear off long hairs, brush and press medium.

Layout:

1,400 ends.
10½/2 reed.
67" inside listing plus ½" for listing = 67½" over all.
Listing of white yarn; each selvage.

Warp:

2¼ run.

Filling:

2½ run.
Weave 4 harness.
Twill to right.

COST CALCULATIONS.

1,400 ends 2¼ run = 6.20 oz. + 10% take-up.. =	6.82 oz.	
6.82 oz. + 15% waste allowance ..... =		8 oz.
68" × 24 picks 2½ run = 6.53 oz. + 10% take-up ..... =	7.18 oz.	
7.18 oz. + 15% waste allowance ..... =		8.45 oz.
Loom weight .....14.00 oz.		16.45 oz.

Finished weight, 12 oz.

Stock:

Good quality B super @ 50c. per lb.
16.45 oz. @ 50c..... = $ .5140

Manufacturing:

24 picks @ $.0160..... = $ .2544

Mill cost ..... $ .7684

MEDIUM-WEIGHT BOYS' SUITING

With Silk Twist.

This is a strong serviceable fabric for boys' suitings. It is made from coarse imported wool, good shoddy or mill waste and silk waste. The silk waste gives it the necessary strength, and will boil out the same as an all-wool cloth. Full to 57 inches wide, scour, dry, shear, steam, brush and press medium. Finish loom length.

13½-Ounce Medium-Weight Boys' Suiting.

Layout:
1,200 ends.

Warp:
9/2 reed; 66 2-3".
20 picks.

PATTERN.

1¾ run grey yarn } 1 1 1 1 1 2 2 2 2 2 1 1 1 1 1 = 20 ends.
2⅝ × 6 run twist } 1 1 1 1 1 2 2 2 2 2 1 1 1 1 1 = 20 ends.

Plain weave.

40 × 5 patterns × 5 sections = 1,200 ends.

Filling:
Pattern and colors same as warp.
20 picks.

YARN CALCULATIONS.

600 ends, 1¾ run, right twist, grey yarn = 3.43 oz. + 10% loom take-up ..... = 3.77 oz.

Twist 12 times per inch.
- 600 threads, 2⅝ run, left twist, black yarn = 2.53 oz. + 10% loom take-up + 8% twisting take-up..... = 3.02 oz.
- 600 threads, 6 run, left twist white silk yarn = 1 oz. + 10% loom take-up + 10% twisting take-up..... = 1.19 oz.

Filling: 68" over all × 20 picks = 1,360.

680 threads, 1¾ run, right twist grey yarn = 3.88 oz. + 10% loom take-up ..... = 4.27 oz.

Twist 12 times per inch.
- 680 threads, 2⅝ run, left twist black yarn = 2.86 oz. + 10% loom take-up + 8% twisting take-up..... = 3.13 oz.
- 680 threads, 6 run, left twist white silk yarn = 1.13 oz. + 10% loom take-up + 10% twisting take-up..... = 1.34 oz.

Loom weight ..... 16.72 oz.
Finished weight ..... 13.50 oz.

STOCK BLEND.

Gray yarn stock:

Medium twist, mule draft 5/8s.

25%	black shoddy @ 12c.....=	$ .0300
45%	white shoddy @ 30c.....=	.1350
30%	white Joria wool @40c....=	.1200
	Cost per lb.	$ .2850

Black twisting stock:

Yarn spun soft, mule draft 5/8s.

50%	black shoddy @ 12c.....=	$ .0600
30%	black garnetted silk @ 36c.=	.1080
20%	black coarse wool @.30c...=	.0600
	Cost per lb.	$ .2280

White silk twisting stock:

Yarn spun soft, mule draft fully 2/3s.

10%	fine white wool @ 56c.....=	$ .0560
90%	white silk waste @ 40c....=	.3600
	Cost per lb.	$ .4160

3.77 oz.	grey warp 1¾ run.		
4.27 oz.	grey filling 1¾ run.		
8.04 oz.	+ 15% waste allowance .....=	9.46 oz.	
	@ 28½c. per lb...=		$.1685
3.02 oz.	black twisting 2⅜ run warp.		
3.13 oz.	black twisting 2⅜ run filling.		
6.15 oz.	+ 15% waste allowance .....=	7.23 oz.	
	@ 22.8c. per lb...=		$.1030
1.19 oz.	white silk twisting 6 run warp.		
1.34 oz.	white silk twisting 6 run filling.		
2.53 oz.	+ 6% waste allowance .....=	2.70 oz.	
	@ 41.6c. per lb...=		$.0702
	Stock per yard.....	19.39 oz.	$.3417
	Spooling and twisting 2.53 oz. @ 3½c. per lb. .....=		$.0055
	Manufacturing cost: 20 picks @ $.0110.=		$.2200
	Mill cost		$.5672

HAIR LINES FOR MEN'S WEAR

It is generally acknowledged that the earliest known weave that we have any samples of is the plain weave, without patterns of any kind, but, no doubt, after a time some inventive and progressive weaver discovered that it was possible to introduce changes in threads or weave, and a new era dawned in the history of weaving. Possibly the first discovery was making the warp one thread of dark colored yarn with one thread of white yarn, and weaving it also one dark and one white, using the plain weave, and there we have the original hair line. In due time from this plain weave hair line there was evolved the four harness crow twill 1x1 hair line and the 2x2 line also.

By this weave it was possible to construct a heavier cloth than could be made by the plain weave, as more ends and picks per inch could be put in, consequently giving better weaving. This weave, Figure 1, dressed 1x1 warp, contrasted colors and woven 2x2 filling, contrasted colors, produces a 1x1 hair line of the same appearance as the plain cloth, but a heavier material. By changing the dressing pattern two blacks and two white and weaving 2x2 black and white, using the same weaving chain as Figure 1, you make a 2x2 line or Regatta stripe as at Figure 2.

Fig. 1.

Fig. 2.

The pattern as it will appear when woven can be easily traced out by referring to Figure 1. Note that the first white warp thread is floated over three picks and must necessarily show the white line for those three picks The fourth pick which binds that warp thread, being a white pick crossing over the white warp thread, makes the continuation of the white line. The

next warp thread, being black, is shown the first pick as binding the thread, and as this pick is black, covering the black warp, it will begin a black line. The warp thread is then floated over the next three picks, which completes the black line, and so on with the other threads. It is quite an interesting study for anyone not a practical designer to pick up a weave chain and apply the warp and filling pattern in this way and so produce the effect of the woven cloth. By combining Figures 1 and 2, as represented in Figure 3, we make a 1x1 hair line on four front harnesses and a 2x2 line on the four back harnesses. The pattern can be made any desired width by dressing the warp, for front sections, one thread black and one thread white for the desired width, and dressing the warp for the back section two threads black and two threads white for the desired width, then drawing the 1x1 on front four harness and the 2x2 on the back four harness, and weaving it 2x2, as marked on chain, Figure 3, you get a combination hair line stripe, being 1x1 hair line for desired width and 2x2 hair line for desired width of stripe.

Fig. 3.

The next step in the evolution of hair lines is to take the single cloth weave, Figure 1, and make a double cloth of it, as shown by weave, Figure 4, which is known as the double plain weave, but it is the same weave as Figure 1 on the face, and same weave inverted for the back. This double cloth weave will allow of making a heavier cloth out of the same yarns, or by using fine yarns, such as worsted yarns, it will make very neat hair lines in a medium-weight cloth. This weave chain dressed and woven as marked on chain will make a 1x1 hair line double cloth, as illustrated. By dressing the warp one thread of grey and seven threads of black, and weaving three picks black and one pick of grey, using Figure 4 weave chain, it will make a 3x1 hair line, face and back being the same. Again, by changing the pat-

Fig. 4.

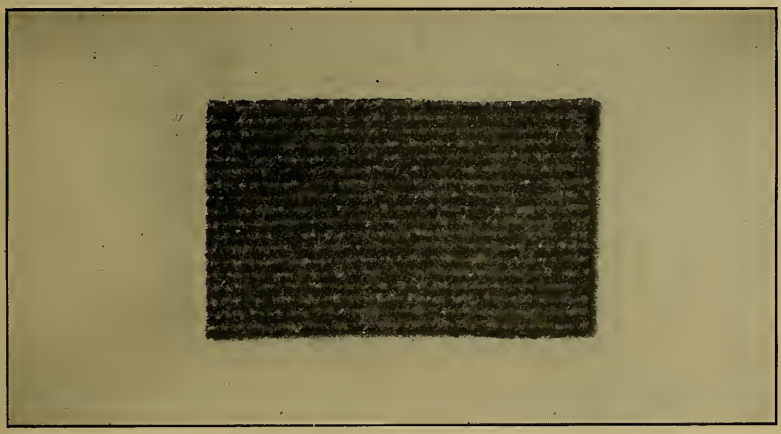
tern in dressing to four threads grey and four threads black, filling two black and two grey, and using the Figure 4 weave, changing the draft so that grey threads are drawn in on harness Nos. 1, 2, 5 and 6, and black threads on Nos. 2, 4, 7 and 8, it will make a 2x2 hair line, face and back of cloth being the same pattern. Although hair lines may be out of style to-day, it was only a few years ago when there was an active demand for them in fine high-grade worsteds, especially in the 2x2 line in combination of skein dyes and mixtures or twists. There is quite a yardage cut up every year in the cheaper grades among the pants manufacturers, so that they may be almost considered a staple cloth.

The 1x1 and 3x1 lines are particularly hard to make perfect, or even reasonably perfect, as any variation in size or imperfection in the yarn, arising from bad carding or spinning, show up very strongly on the finished goods. Hair lines are made in single yarn warp and filling, also all-cotton warp

and shoddy filling, and in combinations of single yarns with double and twist, and in worsteds, skein dyes, mixtures and twists.

Points of Importance.

There are a few special points of importance in the manufacture of these goods, and one of the most important is the absolute necessity of having level and perfect yarns. Yarns that may be used in the ordinary class of work and produce satisfactory goods, if woven into hair lines may be so imperfect as to cause the goods to be classed as seconds. This is a strong statement, but it can be backed up by experience, hence great care is necessary in the preparation of the stock and in th carding and spinning departments.



1 x 1 Hair Line Double Cloth.

If yarns are carded and spun right, it is a comparatively easy matter to dress and weave the goods, but careful attention must be given to the burling and sewing in the finishing department, to see that all threads are in their proper place. All broken ends or threads out must be sewed in before fulling. Full to 55 inches inside listing, and in the finer grades of goods it will make them feel more clothy to full a little in length. Dry to 57 inches inside listing. Shear, brush with steam, press medium pressure, 55 inches inside listing.

We give the layout and cost calculations for three fabrics:

(1) Medium grade single cloth, weave as Figure 2.
(2) A double cloth with half double and twist yarns.
(3) A fine 2-40s worsted in black and white yarns.

Medium Quality 14-Ounce Hair Line.

Layout:
1,600 ends
2 run warp.
Right twist.
11½/2 reed.
70" inside listing plus 2" for listing = 72" over all.

Filling:
2¼ run, left twist.
25 picks.
Weave as Figure 2.
2" for listing.

Warp pattern:
2. Black, 2 run, right twist.
2. Light grey, 2 run, right twist.

Filling pattern:
1. Black, 2¼ run, left twist.
2. Light grey 2¼ run, left twist.
1. Black, 2¼ run, left twist.

Stock mixture—Black:

30% fine medium wool @ 44c... =	$ .1320
70% good black shoddy @ 12c.. =	.0840
Cost per pound	$ .2160

Stock mixture—Light grey:
30% fine med. white wool @ 44c.= $ .1320
30% white shoddy @ 30c.....= .0900
40% good black shoddy @ 12c..= .0480

Cost per pound ..... $ .2700

CALCULATIONS.

1,600 ends 2 run.....= 8.00 oz.
72 + 25 picks 2¼ run.....= 7.60 oz.

15.60 oz.
10% weaving take-up .....= 1.56 oz.

Loom weight ..... 17.16 oz.
17.16 oz. yarn + 15% waste allowance = 20 oz.

10 oz. black @ $.2160 per lb....= $ .1350
10 oz. light grey @ $.2700 per lb.= .1700

$ .3050

Manufacturing:
25 picks @ $.0150.....= .2625

Mill cost ..... $ .5675

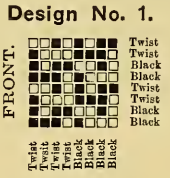
Fine Hair Line, One-Half Double and Twist Yarns.

Layout:
3,200 ends.
11½/4 reed.
69½" inside listing plus 1½" for listing = 71" over all.

Warp pattern:
4. Black and white 8 × 8 D. and T., 22 turns per inch, right twist.
4. Black, 4 run single, right twist.

Filling pattern:
2. Black, 4 run single, right twist.
2. Black and white 8 × 8 D. and T.
6% take-up in twisting yarns.
Weaving chain on 8 harnesses.
2 harnesses for listing.
Straight draw.

Design No. 1.



CALCULATIONS.

1,600 ends 8 × 8 twist + 6% take-up = 3.76 runs.....= 4.25 oz.
1,600 ends 4 run.....= 4.00 oz.
71" × 44 picks = 3,124.
1,562 threads 8 × 8 twist + 6% take-up .....= 4.15 oz.
1,562 threads 4 run.....= 3.90 oz.

16.30 oz.
Plus 10% take-up .....= 1.63 oz.

Loom weight ..... 17.93 oz.

4.25 oz. twist warp.
4.15 oz. twist filling.

8.40 oz. + 10% waste .....= 9.33 oz.
4.00 oz. black warp.
3.90 oz. black filling.

7.90 oz. + 15% waste .....= 9.30 oz.
Stock for twisting yarns:
Fine picklock wool @ 68c. per lb.
Stock for black yarn:
60% fine med. wool @ 56c.....= $ .3360
40% fine shoddy @ 24c.....= .0960

Cost per pound..... $ .4320
9.33 oz. twist @ 68c. per lb.....= $ .3965
9.30 oz. black @ $.4320 per lb..= .2511

$ .6476

Manufacturing:
44 picks @ $.8600.....= .3784
Extra for twist..... .0240

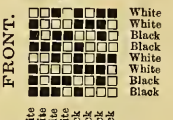
Mill cost $1.0500

Fine Worsted 2x2 Line.

Layout:
5,600 ends.
2/40s worsted.
13½/6 reed.
69" inside listing plus 1" for listing = 70" over all.

Warp pattern:
4. White 2/40s.
4. Black 2/40s.

Design No. 2.



Filling pattern:
2. Black 2/40s.
2. White 2/40s.
66 picks.

Weave chain:
Straight draw.
8 harness.
2 harnesses for listing.

CALCULATIONS.

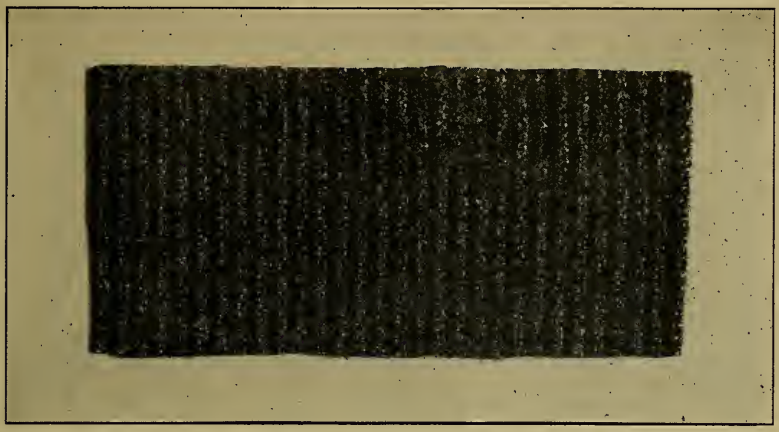
5,600 ends 2/40s.....= 8.00 oz.
70" × 66 picks .....= 6.32 oz.

14.31 oz.
Plus 10% take-up.....= 1.43 oz.

Loom weight ..... 15.74 oz.
2/40s worsted 15¾ oz. + 6% waste = 16.75 oz. @ $1 per lb. .....= $1.0469
Manufacturing cost and charges.... .4620

Mill cost $1.5089

In the finishing of these hair line worsteds they are improved in handle by giving the goods a slight filling. Goods should be scoured first and dried out, then examined for imperfections, which should be carefully repaired. The goods are then fulled with a good neutral soap for 30 to 50 minutes, or possibly longer—it will depend largely on conditions. Dry at 57



Fine Hair Line, One-half Double and Twist Yarn.

inches. Steam, brush and shear. Press medium hard, blowing steam on face of goods. Keep on roll all night. If this fabric is made in double and twist or mixture yarns, which will cost 25 cents per pound more than regular yarns, it would add to the cost of stock at least 10 cents to 12½ cents a yard, but as there would be labor charges for dyeing, winding and spooling, there would be a slight reduction in the manufacturing cost.

COVERTS AND VENETIANS

This cloth received its name in England many years ago, because it was used at one time almost exclusively as a sportsman's cloth for shooting coats, etc., its neutral tones of color blending with the rocky ridges and stones, also with the autumn shades of heather, furze and grasses, making it an ideal cloth for use in the coverts, which is the English term for the hiding places of the game birds. Hence, the name "covert cloth" was applied to this particular cloth. The cloth is now used extensively for men's spring and fall overcoatings, ladies' wear skirts, suitings and cloakings, although the ladies' trade use more of the single yarn coverts in mixtures, etc. The real covert cloth is always made from double and twist warp yarns, with single yarn fillings, but, as noted above, many cloths are called coverts because they are woven with the covert weave, but are made of single yarns. The so-called single yarn coverts are really Venetians, and are known as such by all manufacturers.

There is always considerable latitude allowed in the trade regarding the name or style of a fabric, especially in the ladies' wear, and we can find many different fabrics, all known as coverts in the cloaking trade, and while most of them have some of the characteristics of coverts, yet they are not the genuine covert as judged from the woolen manufacturer's point of view.

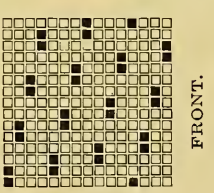
There seems to be a leaning at present toward this one-time popular cloth, and it is noted in the English fashion reports that it is again gaining in popularity. There is every reason to believe that it will once more become a leading fabric in this market, and a brief outline on different makes of Venetian and coverts, with suggestions regarding their manufacture may not be amiss, as we shall take up yarns and weaves used in a few of the more expensive heavy-weight English Venetian coverts, with some points in their construction and manufacture.

Heavy-Weight Covert Cloaking.

A heavy-weight Venetian covert cloaking, with a pronounced whipcord effect, is made with a 15-harness sateen weave, as shown in Design No. 1. This weave is better adapted for fine yarns in mixtures than in the twist yarns. The warp yarn may be in a tawn mixture shade or in a khaki shade in mixture, while the filling should be a similar tone of color, but a solid shade, that is, all dyed in the stock and without any admixture of white or fancy colors. The weave is so constructed that the filling yarn does not show on the face of the goods, and almost any shade, similar in the general tone of the warp, may be used as a filling.

An excellent warp mixture is 65 per cent of a light fawn wool, 25 per cent white wool, 5 per cent brilliant green wool and 5 per cent old gold wool, spun to 6 run right twist, with filling of a solid fawn shade, spun to 3 run right twist.

In making the selection of wools for the percentages of white and fancy colors for this mixture, it is absolutely necessary to get the best quality of AA pulled wool, which will largely eliminate any danger of specks or nibs in the carding. Unless the cards are in first-class condition, no one should attempt to make this yarn, as any speckledness in the mixture would



Design No. 1.

ruin the goods and give them a cheap appearance, and no amount of work afterward in the finishing department will overcome any imperfection of mixture in the carding. It is the clear, perfect mixture in the warp face of these goods which gives to them the snappy character, and lifts the cloth out of the common run of Venetians.

Layout for Design No. 1:
5,760 ends.
72" wide in reed.
Reed 16.5 in dent.
76 picks.

Warp yarn:
6 run, right twist.
Filling yarn:
3 run, right twist.
Loom weight 32 oz.
Finished weight 29 oz.
54" inside listing.

This cloth should be woven face down, and the weave plan is marked out that way. Weave twill to right on face. In finishing it should be fulled in length at least 7 or 8 per cent, which will cause it to hold about 5 per cent shrinkage in length when finished. Take out of fulling mills at 56½

inches inside of lists. Goods should be woven with a wide special listing, and goods should be tacked together at listing, face of goods inside. This tacking together of the lists is necessary to prevent rolling of the lists when fulling. If not tacked, the piece would roll up in a rope the entire length, and if continued to run in this condition in the fulling mill would completely ruin the goods.

Fulling and Scouring.

After fulling and scouring, the goods should be put on a wet gig, using old teasels, giving a few runs, not to cause a nap, but to straighten out the fibres on face, so it will be possible to get a clear, smart finish when sheared. After giving it a few runs on shears, reverse the piece end for end, and give it a few runs at a lower notch, which will give the goods a smart, clean appearance and bring out the whipcord effect. Steam brush well, press medium, giving a little steam on face as the piece is rolled up. Keep on roll for 10 to 12 hours before unrolling.

A much neater design than the foregoing may be made on the 10-harness sateen, as shown in Design No. 2. This weave is also adapted more for a fine mixture warp than for twist yarns, but it could be made in fine worsted in two-tone twists. This weave has always been a favorite one for ladies' cloths, such as cloakings or coatings. It makes a fabric which drapes well, if fashion so demands it, and at the same time it is solid enough in texture to hold its shape if made up in a close-fitting garment. It is not such a popular weave for men's wear, unless a bold Venetian effect is wanted.

The usual weave for men's wear Venetians is the regular 5-harness doeskin weave, Figure 3, and for men's wear coverts, twist warps, Figure 4.

Figure 3.
5 harness doeskin.

Figure 4.
5 harness covert.

Layout for 10 harness sateen cloth:
5,320 ends.
71" wide in reed.
15 Reed, 5 in dent.
60 picks per inch.

Warp mixture:
6 run yarn, right twist.

Filling:
Solid shade 3 run yarn, right twist.
Loom weight 24 oz.
Finished weight 20 oz.
54" wide.
Manufacturing particulars same as the 15 harness sateen.

If anyone desires a still lighter weight cloth than the above two examples, 10 and 15 harness, and at the same time retain a like balance of structure, it would be necessary to use an 8-harness sateen weave, and a finer spun filling, if it is desired to make it in woolen yarns. For instance, if one desired to make a 16-ounce cloth, but having the same balance of structure and character as fabric No. 2, a satisfactory layout would be as follows:

Layout for 8 harness sateen cloth:
5,320 ends.
71" wide in reed.
Reed 15.5 in dent.
54 picks per inch.

Warp mixture:
6 run yarn, right twist.
Filling:
3½ run yarn, right twist.
Loom weight 20 oz.

Finished weight 16 oz.

These three examples are good, high-grade Venetian coverts for ladies' wear, and while they are not difficult goods to make, it requires care and watchfulness in selecting the right stock for the warp mixtures. As mentioned before, the mixture must be carded free from any nibs or specks, and the yarns should be smooth, round and level. Any roughness of the yarns detracts from the sightliness of the goods. A manufacturer would express it that the yarn should have a "skin" to it, meaning smooth and even. It is such yarns that give beauty and character to the goods, something distinctive in itself, like that innate good breeding which is the distinctive character of a gentleman.

It is always more satisfactory to weave all of these sateen weaves with the face down. This is self-evident, if one will look at the weave chains. Take the 15-harness sateen. If this was woven face up, each warp thread would be raised up 13 times consecutively, and then down for 2 picks. In other words, 13 harnesses would have to be raised up each pick, and if it was being woven in an open shed loom there would be great danger of warp threads floating, causing imperfections in the cloth. These weaving chains are, therefore, made out to weave face down.

Cheap Attractive Venetian Covert.

A cheap and yet an attractive Venetian covert can be made as a piece-dyed fabric, union mixture. They are made with different percentages of cotton, but if over 30 per cent is used, the cloth will handle cottony and hard. The cotton is mixed with the wool stock previous to carding, and in order to produce a satisfactory fabric, free from cotton specks, it is absolutely necessary to use a double-combed cotton stock. This will cost a good deal more than the ordinary carded cotton, but it is the only safe stock to use when making this kind of a fabric. The best carded or double-carded cotton stock cannot be depended upon, as it will show up most unexpectedly small specks after the goods are dyed, and the darker the shades of the goods the more pronounced will be the specks. These specks are generally so small that they cannot be detected in the yarns, and will not show until after dyeing, the carding, spinning and weaving being all done in the white stock. The overseers and superintendent, unless experienced in such goods, would not suspect that the yarns would show specky. The writer knows of a case of this kind where several hundred pieces in process were all more or less specky, and it was not known or suspected until the first pieces were dyed.

These specks are caused by the fact that in carding very little of the short fibres of the cotton are taken out, the object of carding being to take out dirt and nibs, and lay the fibres parallel, including both long and short staple fibres. In the process of combing the cotton stock, the object is to remove all nibs and short fibres, retaining only the longer staple, and lay them parallel with each other. Thus you will readily see why the combed cotton stock is the proper stock to use in making this fabric.

If this union mixture in Venetian is properly made and dyed into the fashionable shades of costume cloths, it will compare very favorably in appearance with the higher grades of all wools. The yarn should be spun soft, with just enough twist in the warp yarn to insure good weaving, and the filling yarn just twist enough to weave well.

Layout for piece-dyed cotton mix. Venetian:
4,000 ends.
34 holes; twist on a Davis & Furber mule.
Reed 15.4 in dent.
66 2-3" inside list plus 1⅓" for listing = 68" over all.

Weave:
8 harness doeskin, straight draft.
2 harnesses for listing.

Warp:
4¾ run, left twist.

Filling:
40 picks per inch.
2⅛ run yarn, left twist.

Warp stock mixture:

30% white dou. combed cotton @ 24c.	$ .0720
20% white fine wool carb. @ 54c.	.1080
25% white fine noil carb. @ 42c.	.1050
25% white worsted yarn waste @ 38c.	.0950
Cost per pound	$ .3800

Filling stock mixture:

25% white carded cotton @ 16c.	$ .0400
20% white garnetted waste @ 38c.	.0760
30% white fine shoddy @ 30c.	.0900
25% white light fawn shoddy @ 20c.	.0500
Cost per pound	$ .2560

4,000 ends 4¾ run warp = 8.42 oz. + 10% take-up = 9.26 oz.
68" × 40 picks = 1,920.
1,920 2⅛ run filling = 1,284 + 10% weaving take-up = 14.12 oz.

Loom weight ..... 23.38 oz.

9.26 oz. yarn warp + 8% waste allowance = 10 oz. @ 38c. per lb.	$ .2375
14.12 yarn filling + 15% waste allowance = 16.6 oz. @ $.2560 per lb.	.2656
	$.5031

Manufacturing cost:

40 picks @ $.0900	.3600
Mill cost	$.8631

Full to 56 inches in width, inside list. Shrink in length to hold 5 per cent when finished. Scour thoroughly, using plenty of warm water in washing off, in order to insure against any soap being left in the goods. It is always a safe plan to add a few quarts of ammonia to the last scouring bath, which will quickly emulsify any soap, and allow of its being readily washed out by the warm water. After scouring, the goods are ready for the dyeing process, and before dyeing the pieces should be run in boiling water with a little ammonia added as a precautionary measure against any possibility of soap or grease being yet in the goods. Some soaps of the cheaper grades are made from impure ingredients, and adulterations are extremely hard to get washed out, and as these cloakings have to be dyed into many very delicate shades, the slightest trace of any foreign matter in the pieces will cause uneven dyeing and streaky goods, and once pieces are uneven or clouded in the dyeing it is impossible to remedy the unevenness without first stripping off all the color and re-dyeing again. All of this costs time and money, and besides the goods never handle so well afterwards. Any stripping and re-dyeing is always at the expense of the appearance and handle of the goods, and prevention of the trouble is much better than correction afterward, and, as mentioned above, a little ammonia added to the last scouring bath will be of great help in thoroughly cleansing the goods. The action of ammonia in emulsifying all fatty acids is very strong, and is much more rapid in its action than either soda or potash liquors. It has the peculiar property of increasing the action of other alkalies in scouring of woolens and when used in the scouring process will insure a more thorough emulsification of all fatty acids, and, consequently, a cleaner piece of goods, and level shades in the dyehouse. Ammonia may be used to advantage in both finishing room and dyehouse, without any danger of injuring either goods or colors, provided reasonable care is exercised in its use, and that it is properly diluted. There are several colors, however, which are changed somewhat by ammonia fumes or by coming in contact with a solution of ammonia. For instance, acid colors, in delicate shades, are always altered by ammonia fumes, or on coming in contact with any alkali, and goods dyed with acid color should not be allowed to come in contact with any alkali. Ammonia should not be used in the fulling mills, or in any machine where it may come in contact with brass or copper rolls, because a strong solution, when it comes in contact with such metals, will form at once cuprammonia, and cause a stain on white or light colored woolen goods, which no amount of washing will remove, and as such stains have a strong affinity for dyes, it will show much

darker after dyeing. Such stains on this Venetian fabric would scarcely be noticed before dyeing, but afterward will show up quite distinctly, and cannot be removed.

These goods are dyed with wool dyes, after being given a light chroming, such shades as light and medium tones of fawn, light olive, khaki shades, light blues and black. The mixture effect is caused by the white cotton in the stock mixture, which is not colored by the wool dye, and, therefore, shows equal to a 30 per cent white mixture. The fabric may also be dyed into solid shades by using union dyestuffs, coloring similar shades as above, but the fabric is not so attractive, as it lacks the mixture effect. When colored in solid shades, it is not necessary to use combed cotton in the stock mixture, the ordinary carded cotton being quite good enough, as in solid shades colored with union dyes there is not any danger of specks.

Another Piece-Dyed, Cotton Mixture Covert.

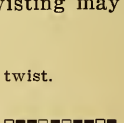
Another piece-dyed, cotton mixture covert for ladies' spring and fall coatings is made with a fine white cotton thread twisted with another and heavier spun yarn. This yarn may also be a union mixture, that is, a mixture of cotton and wool carded and spun together. The white cotton thread should be much finer than the union mixture yarn. If this thread is heavy it will make the fabric look open and coarse and also gives a hard cottony handle. A good proportion would be a union mixture of 30 per cent carded cotton with 70 per cent fine wool spun to 4¾ run left soft twist—about 19-20 holes of twist on a Davis and Furber mule. This yarn is twisted right twist with a 40s white cotton thread, 18 turns per inch. The 30 per cent carded cotton is colored a fast shade of stone drab before being mixed in the batch, and dye must be fast to cross dyeing. The percentage of wool should be a fine short staple grade free from any shive or burr. A good fall California carbonized and neutralizedized is a good wool to use, and there can also be a percentage of garnetted white yarn waste. This fabric requires a nice level thread, because any unevenness will show up very strong after being twisted with the white cotton thread, and as the yarns are carded, spun and woven, in a very light shade, any unevenness will not be so easily detected until after the goods are dyed and finished, and as there would naturally be many pieces in process, the loss would be quite serious if much uneven yarn was allowed to pass. Hence the carding and spinning overseers must give special attention to the product as it passes through their respective departments. As the yarns are quite fine, if properly prepared and carded, a spinner should be able to run two mules, say, 600 to 800 spindles on piece work, and get off a good production also. Weavers should operate two looms on such work, which would lessen the labor costs by at least one-third of the usual cost on regular goods. When getting ready to twist the spun yarn with the white cotton thread, it is usual to spool the two yarns together, and careful attention should be given to the tension on the several threads, so that the twist may be as perfect as possible. Twisting may be done on either mules or on regular twisting machines.

Layout for 14 oz. piece-dyed double and twist union covert:

2,800 ends.
8.5 reed.
70" inside listing + 1" for listing = 71" over all.

Yarns:
Union mix yarn, 4¾ run. left twist, soft. twisted with 1/40s cotton peeler combed yarn; twisted 18 turns per inch to right.
Draw straight on 10 harnesses.
2 harnesses for listing.

Filling.
4¾ run. left twist.
40 picks.



CALCULATIONS.

2,800 ends 4¾ run = 5.88 oz. + 6% twisting take-up .....=	6.23 oz.
2,800 ends 1/40s = 1.33 oz. + 10% twisting take-up .....=	1.46 oz.
71" × 40 picks = 2,840.	
2,840 ÷ 4¾ run filling = 6.50 oz. filling.	
6.23 oz. + 10% weaving take-up .....=	6.85 oz.
1.46 oz. + 10% weaving take-up .....=	1.60 oz.
6.50 oz. + 10% weaving take-up .....=	7.35 oz.
Loom weight	15.80 oz.

Finished weight 14 oz.

Warp and filling stock mixture:

30% carded cotton, dyed, @ 16c=	$ .0480
70% fine short wool, carb., @ 44c.=	.3080
	$ .3560

Single 40s combed peelers, on cones, 40c. per lb.
6.85 oz. warp.
7.35 oz. filling.

14.20 oz. + 10% waste allowance = 15.60 oz. @ $.3560 per lb. .....=	$ .3471
1.60 oz. cotton + 3% waste allowance = 1.65 oz. @ 40c. per lb.	.0412
	$ .3883
Manufacturing cost (2 loom work): 40 picks	.2400
Mill cost	$ .6283

These goods are fulled in the grease, giving them a slight shrinkage in length, so they will finish loom length. Give a thorough scouring and wash off with plenty of warm water, using a little ammonia in the last scouring to insure freedom from soap. Goods are now ready for dyeing, but previous to dyeing they should be run in boiling water, as recommended for the cotton mixture Venetian cloth. Chrome lightly, and dye to shade with wool dyes, which have no affinity for cotton. The white cotton thread should show up clear white, as any stain on this cotton thread caused by a poor selection of dyestuffs or improper handling in the process, will give the goods a muddy appearance, and detract from their selling value. If the finishing room is equipped with a sand papering machine it will greatly improve their appearance and handle if given a few runs on it. Finish clear, press medium. Finish 55 inches inside listing.

To compete successfully in the manufacture of this class of goods, the mill should have its own carbonizing plant, so it would be possible to buy defective or burry California wools, and do all its own carbonizing and neutralizing.

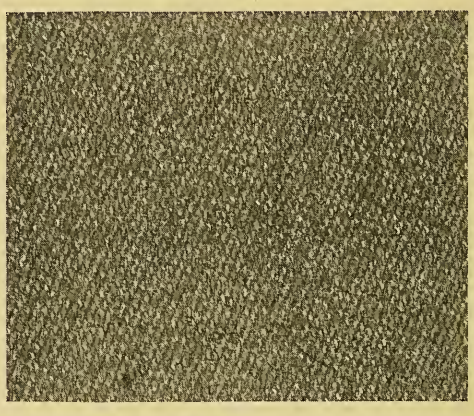
Men's Wear, Fine All-Wool Covert. Double and Twist Warp.

This is the genuine covert cloth which was named "covert cloth" in England many decades ago. This cloth is usually considered one of the hardest cloths to make perfect, as any imperfection or irregularity in the yarns before being twisted, and any variation in the twist will make a streaky piece of goods. Those mills which have tried to make this cloth and failed to turn them out satisfactorily, failed because they did not give proper attention to the selection of the proper wools. Given the proper wools for making a good level thread, and ordinary care exercised in the details of manufacture, any well-equipped mill should be able to turn out a reasonably perfect piece of twist covert. No mill should undertake to make them unless its card room is well equipped, card machines well clothed, doffer rings in perfect condition. The mules should be also in good condition. No loose collars or collar-boards. No wornout steps. Feed rolls should be true and smooth, any creases will make imperfect yarns. Spindles bands should be renewed, and every endeavor made to get equal tension on every spindle. Spinners must not be allowed to pick up and piece ends after the carriage is out, as such would make a heavy thread whenever it is done.

An Old Adage.

There is an old adage in Yorkshire, "That stock well carded is half spun and yarns well spun are half woven, while cloth well woven is half finished, and goods well finished are half sold." This is quite true in a general sense, as any concern turning out satisfactory goods, right up in style, fabric, and finish, having few imperfections or allowances, is soon recognized

by the trade as a dependable and satisfactory concern to deal with, and buyers will naturally seek to place their orders with a mill having a reputation for delivering satisfactory goods, well finished, and practically free from imperfections of weave or yarns. The above adage is very applicable to the manufacture of these twist coverts. Stock well carded, that is, free from twits, a nice even roping will give a round, smooth yarn, that is necessary to procure an even twist for this cloth. The stock requires careful selection. For the white yarn the wools should be "pick lock" the finest selections from XXX Ohio or similar wools. The colored yarn may



14-Ounce Double and Twist Union Co vert. (Piece-Dyed.)

be from the next grade, but it is not economy to lower the quality very much. The best is none too good to spin to 7 run and 10½ run yarns. The scouring of the wool and the dyeing requires careful attention and good judgment on the part of the overseer. The wool must not be matted or felted in the slightest, but should come out of the kettles as lofty and open as uncolored stock. Cold water should not be turned on the stocks when washing off at the dye kettles, but the change should be gradual. Run about half the hot liquor off, then turn on the cold water, which will bring the temperature to about 130 degrees, pole the stock in this water, and then run off. If the stock is properly handled in this department the carder should have no trouble in getting good results, but if the stock is matted or felted in the dyeing, it is practically impossible to obtain good results in carding, and without good carding it will be very unsatisfactory in succeeding departments, and the final result will be discouraging.

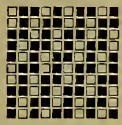
An Open Question.

Presuming now that the yarns are well carded, spun, and bobbins ready for twisting. The best method to combine the two threads for twisting is to spool the yarns on separate spools, 20 threads to a spool. Some manufacturers prefer spooling the yarn on one spool, one thread white, one thread colored, alternately. It is an open question as to which is the better method, but whatever method is used, it is certainly the best policy to spool the yarns previous to twisting, as there is a more even tension to the threads, and consequently a more even twist. After twisting, every bobbin should be inspected, and any uneven twisted bobbins should be sorted out and laid aside. The twist yarns being now ready for spooling previous to

dressing, all guide and tension hooks should be examined, and if any hooks or guides are cut and worn, they should be replaced as any inequality in the tension of the threads will cause imperfections. The reed in the loom should also be examined for uneven dents, as wide or narrow spaces will cause streaks or reed marks, which cannot be overcome afterwards. Examine carefully from weave room, mark all imperfections of weave or yarn, and have them corrected by an experienced sewer. Goods may be fulled in the grease, using a good bodied soap free from cheap adulterations. It will take from 2 to 2½ hours to full, it is also necessary to overhaul the pieces during the process of fulling. Take and snap out the cloth to prevent mill wrinkles, which are caused by the goods running continuously in the one fold. Goods should be fulled in length at least 6 per cent or 8 per cent, which will give them a full clothy handle. After scouring, they should be given a wet gigging on old teasels or on a fibre brush gig, and rolled up wet over night. Extract and dry next day at 57 inches wide. Shear, steam, brush, press medium pressure. They may then be given a cold water shrink and plate pressed.

Layout for men's wear double and twist yarns:

3,800 ends.
14½/4 reed.
65½" inside listing plus 1" for listing = 66½" over all.
Draw straight on 10 harness.
2 harnesses for listing
Weave twill to right.
54 picks.
7 run yarn, spun left.



Warp yarns
1 thread 7 run, left twist, dark shade.
1 thread 10½ run, left twist, white.
Twisted 24 turns per inch, right twist.
Take-up in twisting 8% = 3.9 runs.

CALCULATIONS.

3,800 ends 3.9 runs twist.....=	9.74 oz.
66½" × 54 picks = 3,591 threads ÷ 7 run filling .....=	5.13 oz.
	14.87 oz.
10% weaving take-up .....=	1.48 oz.
Loom weight	16.35 oz.

Finished weight 14 oz.
16.35 oz. + 10% waste allowance = 18 oz. @ 70c. per lb., + 6% shrinkage .....= $ .8372
Fine quality picklock wool.

Manufacturing costs:

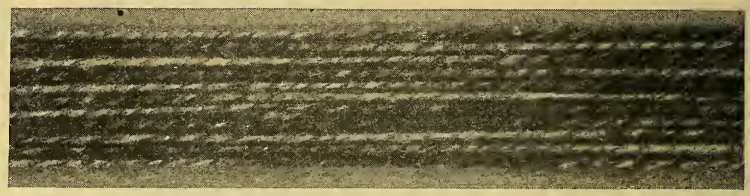
54 picks @ $.7600 + 6% shrinkage	.4366
Extra expense, fine spinning and twisting, 1½c. per oz. over cost of single yarns	.1500
Mill cost	$1.4238

No mill should undertake to make this class of goods unless it is equipped with more than the ordinary number of cards as compared with the number of looms. As the production from the carding room of 7 and 10½ run yarns is necessarily slow, the ordinary carding equipment would not be sufficient to keep all the looms running, hence lessened production of woven goods, and consequently increased overseers and general charges.

WOOLEN NOVELTY DRESS GOODS

The latest style news from Paris that homespuns, tweeds and coverts are being worn by the smartest women who attend the French races is of special interest to sales agents and manufacturers. The fabric illustrated here is a Scotch novelty dress goods very applicable to the above suggestion; also to the combination suit which is a coat of one design or fabric and a skirt of another, such as a black worsted cheviot, with a skirt of a plaid pattern in tartan colorings. This novelty combines the homespun fabric with the fancy tartan colorings, and is a very effective novelty. This fabric, so far as the writer knows, is not yet placed on this market, and there is a good opportunity for domestic mills to get out a similar cloth for the dress goods trade.

The yarns are heavy and somewhat uneven, made from a coarse wool for the dark stock, while the fancy color is made from a medium fine wool. The yarns are in two tones of color, but instead of being a mixture, the color comes on the thread as an elongated slub or blotch. There are about three inches of a black ground thread and then about 1½ to 2 inches of



Yarns Used For the Scotch Novelty Dress Goods.

a white or fancy colored slubbing twisted into or around the black ground thread, which gives, when woven into the cloth with various color combinations, a very rich and striking appearance. The cloth is plain weave, having few ends and picks per inch.

The Colorings.

The colorings so far as shown are in the following combinations and patterns, but other patterns can be made by using ordinary dark shades of yarn without any blotch effect as a ground cloth, and using the fancy blotch yarn to form patterns, a cloth dressed and woven four threads black ordinary yarn, four threads fancy blotch yarns, both warp and filling, would show up effectively. Other and larger plaid effects could also be made. In fact, there is no limit to exploiting this novelty yarn, as indicated in the accompanying table:

A Few Coloring Combinations:

WARP.	FILLING.
All black and white Blotch.	All black and white Blotch.
All brown and white Blotch.	All brown and white Blotch.
2. Black and Tartan blue Blotch.	2. Black and Tartan Green Blotch.
2. Black and old gold Blotch.	2. Maroon and crimson Blotch.
2. Black and white Blotch.	2. Black and Tartan Green Blotch.
2. Black and old gold Blotch.	2. Maroon and crimson Blotch.
All black and white Blotch.	2. Black and white Blotch.
2. Black and white Blotch.	2. Black and old gold Blotch.
2. Black and old gold Blotch.	2. Black and Tartan blue Blotch.
2. Black and Tartan blue Blotch.	2. Black and Tartan green Blotch.
2. Black and Tartan green Blotch.	

All these colorings show up very effectively; they are bright and snappy, especially the combinations of fancy Scotch tartan colors. Some manufacturers may think that these novelty yarns are difficult to make, and require expensive attachments for the cards. A few attachments are, of course, necessary, but they can all be made by an ordinary mill master mechanic. The overseer of carding can generally plan out the necessary details of work to produce these novelties once he is supplied with the idea of how to go about it. The stock for these yarns is prepared and picked as any ordinary lot of stock—that is, the dark shades or ground work of the thread—and is put through the first and second breaker cards the same as a regular lot, and all the novelty effect is added at the finisher card. Over the finisher card there is erected a framework for the purpose of carrying a special spool, made the full width of the card, and if the card is taking off 20 ends each spool—2 spool card—this special spool is filled with 40 ends of heavy slubbing or roving of any fancy color which is desired to be placed onto the ground thread in the form of a blotch. (The wool of this blotch is a finer grade than the ground

thread.) The special spool is made to revolve slowly by any suitable drive from a worker shaft or feed roll, and there is placed underneath this spool another roll covered with narrow strips of card clothing, placed so that they will catch the slubbing as it is delivered and transfer it to the last worker of the card.

This roll also turns slowly, and between it and the slubbing spool there are feed rolls which carry the slubbing and prevent the small roll from bearing off irregular lengths of the slubbing. Any master mechanic can easily arrange the speed movement and the necessary mechanism to convey the slubbing from the spool through the feed rolls to the second roll, having the strip of card clothing, so that the fancy colored slubbing will be deposited regularly on the last worker, and from there to cylinder and doffer rings.

Careful measurements are necessary to make sure that the slubbing will be delivered about the centre of each doffer ring. If it happened to be deposited on the cylinder in such a way that it would be at the edge of the ring, the chances would be that the top doffer would get more of its share of blotch slubbing and the bottom doffer would be minus its share. Any master mechanic in co-operation with the carding overseer should be able to plan out this appliance and have it in successful operation in a few days of experimenting and work.

Another Method.

Another method of making blotchy yarns is to pick and card the colors separately until the stock is through the second breaker card, and in the form of heavy slubbing wound on the old style side drawing rolls. The Apperly feed will have to be taken off the finisher card and replaced with a creel or spool stand to hold at least 40 spools if the card is taking off 2 twenty-end roving spools.

It is necessary also to make a guide to be placed close before the feed rolls. This guide is made with a solid hardwood base, having small upright pieces of wood, dovetailed into the base, and so arranged that the space between these guides will come exactly in line with the centre of the doffer rings. This guide may be likened to a huge comb, having about 1½ inches space between each tooth. It is quite a bit of work to get this guide board properly spaced. The simplest way is first be sure your doffer rings are placed correctly, and properly spaced to cover the cylinder. Then take the base of guide and place it in front of top doffer, and close to the wire, and mark on it the exact space of each top doffer ring. Then do the same with the bottom doffer. If this is done correctly, it will be a comparatively easy operation to dovetail the guide fingers in their proper places, so that the space between each finger guide will correspond to the centre of the doffer rings.

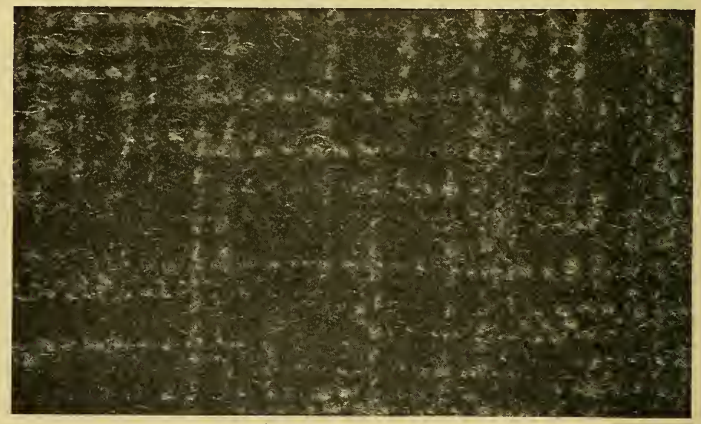
The side drawing spools are then placed in the creel stand in alternate colors, each color having a space of its own in the guide, and if the guide is correctly made and placed properly in front of the feed rolls, the top doffer will take practically all of one color, and the bottom doffer will take the other color. Now to get the blotch or mottled effect, the doffers are caused to vibrate endways by a vibrating motion which can be bought from any maker of cards, or can be made in any machine shop at slight expense. Suppose you have one side drawing of black and one of white placed alternately in the guide, the top doffer black and bottom doffer white. Now vibrate the doffers the width of the rings and you will see the mottled roving at once. The top doffer will move over and strip off the white stock for an instant, then move back to the black, both doffers acting together, thus giving a continuous delivery of black and white roving ready for spinning into yarn. This method will make a very fine mottled yarn, similar in appearance to the first-mentioned method, but the cut-off from one color to the other is not so pronounced, as, by the movement

of the doffers, the two colors intermingle first, and the yarn will show for an inch or so a black and white mottled effect. Then as the doffers move over to the full width of the traverse movement, the yarn will show almost all white, and as the doffers begin the backward movement the colors will again mingle into a mottled effect. Then all black will follow. In the first-mentioned process the blotch color is deposited where it has little chance to get mixed up by the card with the ground color, and the blotch is, therefore, more pronounced in effect.

Mock Twist.

Very rich novelty yarns can be made by this second method by moving the feed guide, so that each strand or color will split on the rings and each doffer ring will carry half of each color, making what is called mock twist. It has every appearance of twist yarn, but the tone is softened, the fibres of the two colors blending together, and not showing the same definite sharpness of outline which distinguishes real twist yarns.

In the manufacture of this mock twist the doffers are run in the usual way. No vibration or traverse movement, but they are given an intermittent motion, which makes bunches or blotches on the roping, which after being spun show up in very striking effects. This blotchy effect may also be produced by an intermittent feeding arrangement, whereby the feed rolls



Scotch Novelty Dress Goods.

are stopped for a brief period, and then started again. This has been accomplished by breaking out one or more teeth in the driving gear operating the feed rolls. The same effect has been produced by pulling wires out of the doffer rings. This is rather expensive unless you have an old set of rings, which are good enough for this work.

Pull out the wires on each edge of the rings for an inch or more, leaving a narrow strip of wire in the centre, then leave above the same space of the ring the full width, and pull out as before another inch, and so on until that ring is completed. Do the same with all the rings of that doffer. The other doffer rings are done the same, but the doffers have to be so set in reference to each other that the wide space in the rings of one doffer will lap over the narrow space of the other. This is necessary, as otherwise the card cylinder would not be kept clear, and the result would be a discouraging mess. These suggestions will be sufficient to show any carder how he can produce many novelties in yarns, and it is

always the mill and the man behind it which keeps in the front rank by getting out new ideas that attract the buyers, who in turn keep the spindles and looms busy.

There are many other novelties in yarns and mixtures that may be produced in the card room, and which will be taken up later in another article treating on other fabrics. Thesenovelty yarns are not confined to dress goods, but are equally applicable to men's wear and boys' suitings, but, of course, the colorings would have to be made in suitable combinations for that trade.

Layout:
900 ends.
1½ run warp, Blotch yarn.
Reed 6½/2.
69" inside listing plus 1" for listing = 70" over all.
Plain weave.
16 picks per inch.

Warp:
1½ run, right twist.

Filling:
1½ run, right twist.

900 ends 1½ run .....=	6.00 oz.
70 × 16 = 1,120 — 1½ run...=	7.40 oz.
	13.40 oz.
Plus 10% weaving take-up....=	1.34 oz.
Loom weight	14.74 oz.

Finished weight, 12 oz.

Stock mixture:
60% coarse wool for ground shade @ 35c. per lb.
40% medium fine wool for Blotch @ 54c. per lb.
Cost per lb., in blend, 48c.

CALCULATION.

14.74 oz. ex. loom + 15% waste allowance .....=	17.3 oz.
17.3 oz. @ 3c. per oz.....=	$ .519
Manufacturing cost:	
16 picks @ 1⅛c. .....=	.180
Mill cost	$ .699

In the spinning of these novelty yarns it will be necessary to allow at least 2-3 draft. Yarns are spun fairly hard twist to give the crisp handle to the goods. When burling the pieces do not break or curl off the knots, but pull them through onto the back and leave them on until after the pieces are fulled, scoured and dry. Full to hold woven length, but do not hair up or felt. Take out at 56 inches in width. Scour dry at 57 inches. Back burl, taking off all the knots. Shear off any long and straggling hairs. Press firm. Goods to finish 54 inches inside lists.

COTTON MIXED CASSIMERES

In these days of keen competition manufacturers are compelled to devise all sorts of combinations of stock in order to produce cheap goods, and by skilful manipulation in the blending of the different grades endeavor to make the cloth appear of a much better quality than it really is. Cheap goods and adulterations of stock always go hand in hand; they are inseparable, one being the cause of the other. For some years past there has been a persistent cry in the trade for something cheap, and the manufacturers have been forced into striving to see who can make the cheapest and most attractive goods at a price, and while the trade and the public have demanded cheap goods, they also call for style and fabric.

If anyone has the idea that goods, if cheap enough, will sell irrespective of style, let them try offering goods a little off the popular trend of colorings and fabric, and they will quickly learn that goods, however cheap, must possess attractiveness in both style and colors. There are always many grades of cheap goods on the market. For instance, cotton warps with an extremely low-grade shoddy filling, also all shoddy goods, which are usually tender and of poor weaving qualities. Experience has proved, and again will prove, that goods of an extremely low grade are a poor investment for theconsumer.

The English manufacturers in Yorkshire, the home of the shoddy goods, can give our manufacturers points in the putting together of extremely low-grade woolens. They have special facilities for turning out such goods, at a far less proportionate expense than the American manufacturer, so much so that they couldtake the refuse that is usually thrown out by the domestic mills, and make it up into attractive goods, and the present prospects are that our markets will be flooded with this worthless shoddy goods, which, instead of being of any aid to clothing the working man will be a great detriment.

In Yorkshire they can take such low-grade sweepings and mill fly in combination with the cheapest of mungo that the resultant thread is so poor that it cannot be woven unless there is a fine cotton thread twisted around it to hold the short fibres together. Yet this cloth is sightly, it handles well, is made up in attractive mixtures, and looks stylish enough to deceive the elect. To keep out this showy but worthless class of goods by any means would be doing no injustice to anyone, even from the consumer's point of view.

The Fabric Illustrated.

The fabric we have here illustrated is not a low-grade shoddy cloth, lacking both in strength and wearing qualities, but a fabric made out of good, strong fibres, well constructed, and which will wear as long as an all-wool piece of goods, although it may not retain its attractiveness so long as an all-wool cloth, owing to the percentage of cotton in the mixture. The colors are not so fast, but, compared with an all-wool of similar construction, this cloth, as it is placed onthe market, is not any injustice to the consumer, but rather the reverse, giving him an attractive and serviceable suiting at a low cost.

There are several fibres with which the manufacturer may adulterate his goods in order to reduce the cost of the stock, but the fibre that is in greatest use to-day is that of the cotton plant, which plays an important part in the manufacture of cheap cassimeres, dress goods, flannels and overcoatings, not only in fancy goods but in piece dyes, even worsted cloths, which are generally supposed to be made out of long-stapled wools, are in the cheaper grades adulterated with cotton. Cotton is usually about one-fourth the cost of wool, and can always be procured in any quantity. It is a clean, strong fibre, and in theright proportions will always give a good, serviceable cloth. There is a mistaken idea that exists in the minds of the consumers that a percentage of cotton mixed with the wool and shoddy detracts very much from the wearing quality of the goods, and should therefore be avoided.

No doubt this idea originated from dealers and salesmen advertising their goods as "free from cotton and guaranteed to boil out," thus putting a ban on cotton mixed goods, while, as a matter of fact, many of the cheap goods "warranted to boil out" are not such good value for the consumer as a cotton mixed piece. This is well known to manufacturers and to most of the clothing dealers, and many dealers who formerly would not handle cotton mixed cloths are now doing so, and even give them the preference over a low grade of shoddy goods, as they have recognized the fact that cotton mixed goods are stronger and give better service than the latter grade.

In the successful working of cotton and wool mixtures a great deal depends upon the preparation and blending before the operation of carding. If the mixture has been imperfectly prepared and blended, no amount of skill in the carding can produce a nice clear yarn. Different men may, of course, employ different methods to bring the same results, and while giving the following methods of preparing and blending the stocks,

the writer does not mean to assert that his method is the only proper and correct way of preparing such mixtures.

In the first place, a good staple cotton, the coarser the fibre the better, is the best for fine mixtures, especially if it goes into any fancy mixture where there is danger of specks showing in the goods. A good quality of carded cotton is none too good for such mixtures, but for solid colors, as white, slates, blacks, brown, etc., it is quite safe to use a good grade of peeler comber waste, free from nibs. This is as good as carded cotton for such goods, and can be bought for about 10 per cent less than the price of raw cotton. Good results can generally be obtained by using about 10 per cent of a good staple wool in the blend, which helps to carry the cotton and shoddy, if any, and for the balance it is best to select a short staple wool or noil, free from burr. Carbonized wools are the best to use. The small percentage of good staple wool will give good results in carding and spinning, as it knits together the short fibres and gives a larger production with less waste in manufacturing. There will be fewer "break downs" in the side drawings in card room and much less "piecing up" in spinning, which, of course, will increase the production but will also make a more perfect thread, and, consequently, fewer imperfections and allowances in the finished cloth. The short wool and noils used in the blend have more points or ends than long wool, and those points are brought to the surface in the process of finishing, and give the cloth a softer and more woolly handle.

Preparing and Blending.

Much of the success of our best manufacturers is the result of the care and intelligence displayed in the cleaning and mixing of the stocks and the selection of the stocks used. This applies to the high-grade, fine woolens equally as much as to the low-grade cotton and shoddy mixtures. A good burr picker is an absolute necessity. It was formerly thought that a burr picker was only necessary to clean burry wools, but it is a necessary adjunct to every picker room on all kinds of stocks, as by its use the stock is thoroughly opened and cleaned, for there is a strong suction fan attached to all burr pickers, which will draw out all dust, dyestuffs, etc., leaving the stock clean and open for subsequent operations.

If the shade of mixture allows for it, the cotton should be dyed to the predominating shade of dark color of the mixture, as dyed cotton will not show up so strongly in a fabric as undyed raw cotton. For white and light shades, where it is necessary to use white cotton, better results can be obtained by coloring a proportion of the cotton a bluish stain, which should be fast to a moderate fulling. This gives the color a softer effect, more like a wool white, as a large percentage of white cotton in any mixture always gives an unnatural whiteness to the goods, showing even to the inexperienced purchaser that it contains a large percentage of cotton. Using 10 or 15 per cent of this bluish stain will overcome the cottony whiteness and greatly improve the appearance of the goods.

In many grey mixtures, such as flannels, it is a good plan to use a percentage of a dark blue wool or shoddy along with the black, which will brighten up the shade, and at the same time, counteract the tendency of black cotton to turn a rusty or a greenish shade on continued exposure. In the darker fancy mixtures the best results can be obtained by dyeing the cotton to the darker colors in the mixture, and where there are small percentages of fancy shades always dye them from the wool or shoddy, as the wool fibres will show on the face, because in the process of fulling, the wool fibres naturally work to the surface and show up effectively, whereas in cotton a small percentage of a fancy shade would be dead and lustreless.

All dyed cotton should be run through the burr picker, which will clean it well and open up all lumps, making it free and in an open condition for mixing evenly with the wool. In blending the mixture previous to running it through the mixing picker, place a layer of the cotton first on the floor, then a layer of shoddy, then a layer of wool. This will allow of the oil emulsion being sprinkled on the wool with little chance of any oil getting onto the cotton. Beat the emulsion well into the wool with a long stick or a heavy bamboo rod. Continue laying the blends down as mentioned until the entire batch is down, care being taken that none of the emulsion gets onto the layer of cotton, because if it gets wet it is impossible to card it out clear. Wet cotton is sure to card into small specks. Run the batch three times through the mixing picker, and in order to insure an even mixture some one should mix the stock in the bin as it is delivered from the picker, as the lighter cotton fibres will tend to separate from the heavy shoddy and wool. It requires constant care to get an even mixture in such a combination of stock.

Carding.

No definite rules can be given here about setting the machine, as so much depends upon the stock and condition of the cards that it is impossible to lay down set rules to govern the carding of these mixtures. The most important points are to see that the cylinders and workers are working true in relation to each other, to keep the wire well up, having a good, clean point, setting all parts sufficiently close to comb the stock out gradually without breaking it, and as the stock proceeds forward in the machines the workers may be set closer to the cylinder in order to make a good, clean roping. Run the fancy close to keep the cylinder clear and sharp, and if it throws too much fly reduce the speed or give the wire less pitch. Another thing to note in the carding of cotton mixes is that the cotton fibres will take the point off the wire more quickly than an all wool, and there is also more danger of a hook being made on the wire, caused by the cotton cutting a small crease on the wire just underneath the point. Unless this is noticed it will make poor carding and imperfect roping.

The temperature of the room is also of importance in carding cotton mixtures. If the room is cold it is next to impossible to get good results, as a cold room generates more electricity in the stock, and every carder knows the trouble it causes, especially in the finished card. A warm, humid atmosphere is always best, and the temperature should run 75 degrees at least.

Spinning.

To a casual observer it would not seem of much importance how the thread is drawn in spinning, but all practical and experienced manufacturers know that it is of paramount importance. In the manufacture of fine woolens and close finished goods it is necessary to have a smooth, clean and strong yarn, having a "skin" to it. Every spinner knows how to accomplish this, and he should always draw such yarns accordingly. This will lay all the fibres parallel with each other, giving a smooth skin to the yarn, but in the manufacture of cotton mix yarns a soft and fuzzy yarn is required, therefore, the roping is made finer at the cards, so that the yarns may be spun to the required size without being drawn too much. It just needs sufficient drawing to straighten out the short cotton fibres, which will lie more to the centre of the thread, while the wool, not being drawn to its full stretch, is by the centrifugal force thrown out toward the outside of the thread. This will give the fleecy character of yarn, so necessary to the successful manufacture of cotton mix goods,

and cloth made from yarns so treated in spinning will handle 50 per cent better than goods made from yarns which have been drawn to the full stretch.

This is an important point and worthy of close attention by every manufacturer, whether running on cotton mixes or fine all wools. The various fabrics and finishes require different handling of the yarns, in order to insure a perfect finish and the best goods. A little experimental work will soon determine the accurate amount of drawing and twist to put into yarns for different fabrics and stock mixtures.

It is also of importance not to twist cotton mix yarns too hard, as the cotton fibre takes the twist more quickly and will make a hard, wiry thread, if too much twist is put in. Twist warp yarns just enough so that they will weave well and filling yarn with enough twist to follow the shuttle without breaking. A well-known superintendent, experienced in the manufacture of this class of goods says "he puts in as little twist in his yarns as he dares to," and then instructs the spinner to take out one hole of twist, by this method he is always sure of getting the yarns spun soft enough.

Weaving.

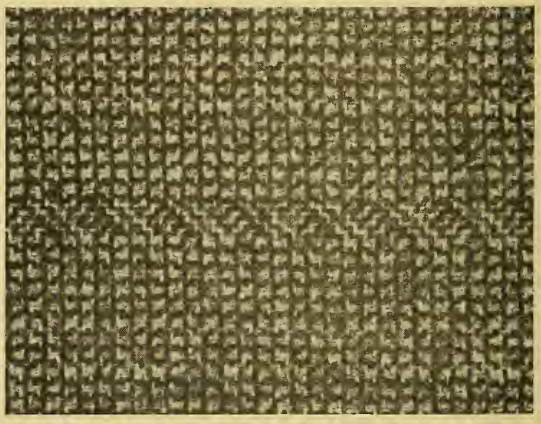
In the weaving department, or perhaps more properly in the designing department, considerable experience is necessary on this class of goods in order to lay them the correct width in the reed to get the best results in fabric and finish. If the goods are too wide, necessitating long fulling, they will finish up hard and boardy, and if too narrow, they will look raw and cottony. No definite rule can be laid down as to the proper width, as it depends entirely on the percentage of cotton in the mixture, the amount of twist in the yarn, the number of ends and picks per inch, and the weave. There are so many factors that it is impossible to give any definite width to lay in the loom. Nothing but experience and close observation of different weaves and cloth structures will guide one in this important part of cloth composition. We must remember that cotton has no fulling properties, and the cloth cannot be set very wide in the reed. We must also remember that each thread, both in warp and filling, occupies a certain space according to the size of the yarns, and the number of intersections in the design, and while in all-wool goods in a heavy fulled cloth it is possible to crowd yarns together a good deal, we cannot crowd cotton mixed yarns too closely, as the goods would feel as hard and stiff as buckram when the ends are overcrowded. Filling yarns should always be spun finer than the warp yarns, as this will balance the pattern better and make a nicer piece of goods.

Finishing.

In the finishing of goods in any grade it is an important point to preserve all the colors in their original purity and brightness. Nothing so mars and detracts from the selling value of a piece of goods as dull and muddy colors. Having all the colors bright and snappy is often the success of a line, and is of great assistance in the selling. If properly handled in the fulling room it is not necessary to scour these goods previous to fulling. This statement presumes that the stock was properly handled in the dyehouse, and that a wise selection was made of the dyestuff used, but if reasonable care is exercised in the process of dyeing, together with proper handling at the fulling mills, such goods may be safely fulled in the grease. However, if a mill is using bought shoddy in the colored state, all such colors should be thoroughly tested to see if they are stainless when fulled along with the white cotton, and if such shoddies show any stain on the white, then the goods should be scoured out before fulling, but it will be necessary to see that the soap is of sufficient strength and body

to saponify the grease and to keep it so until the goods are fulled and washed off. It is a good plan to watch the goods carefully when running in the mills, and to know that the soap is "showing life" all the time. If the soap becomes dead, that is, if the alkali is not strong enough to keep the grease thoroughly saponified all the time, then the dirty sludge, full of dye stain, may set on the goods and stain the colors beyond redemption. Eternal vigilance is the key to success in the finishing room.

After fulling, the goods should not be allowed to lie on the floor for any length of time, but, if possible, should be at once transferred to the washer and well rinsed off with warm water, and then given a slight soap bath, along with a quart or two of ammonia. This will bring up the suds in a snow-white foam, proving that the goods are clean. Always rinse off the soap with warm water, and be sure that the soap is all out of the goods before turning on the cold water, as the latter will set the soap in



Cotton Mix Fancy Cassimere.

the goods, and especially so if the water is hard, containing more or less lime in solution. It will not only set any residue of soap in the goods but it will form an insoluble lime soap which is almost impossible to get out by any after treatment, and any soap left in cotton mixed goods will render them stiff and clammy to the feel, while if thoroughly rinsed, they would appear soft and woolly.

It greatly improves the handle of these goods if they can be given a few runs on a wire napper before fulling, say two runs on face and one on back, not to raise much or any nap, but just enough to scratch the surface and soften it. Then the subsequent operations of fulling and scouring will increase the softness and enhance the appearance.

When drying such goods see that they are thoroughly extracted first, and do not dry at too high a temperature, as too hasty drying will give them a harsh and stiff handle, yet they must be thoroughly dry when run off the machine. Shear on face, but not too close, cut off long fibres only, and leave all the fine bottom to give softness. Give a run on brush, but very little steam, as any dampness in such goods at time of pressing will cause them to feel stiff and hard. Press lightly, and give a very light steam on face as the pieces are going onto the roll. Leave on roll until next day.

Success in manufacturing this or any other kind of goods depends principally on economy in production. Always aim to have the stock good

enough to carry its own manufacturing waste, as carding and spinning soft waste should never be allowed to accumulate. It is a sign of bad management both in the superintendent and the carding overseer, and should always be used up in succeeding batches of the same shade and grade of goods, and in the case of odd mixed lots and colors, they can always be dyed black and put into lots or batches of the same grade of goods.

No manufacturer to-day can succeed and keep in the front rank in any grade of goods if he is content to have his goods just the same as his competitors. Contentment and success are incompatible and cannot join hands. The man who is always trying to improve, either in quality or style, will come out ahead, while the contented man will be forced out of the race, and will wonder how it is that the other man is having such good luck to keep his looms running all the time. It is simply the fulfillment of a natural law, "the survival of the fittest."

Layout for Cotton Mixed Cassimere:

2,560 ends.
10/4 reed.
64" inside list. plus 1" for list. = 65" over all.
42 picks per inch.

Warp yarn:
4¼ run, right twist, soft.

Filling yarn:
4½ run, right twist, soft.

Stock mixture for white:

60% white peeler comber waste @ 12c. ....=	$ .0720
10% white fine wool carbonized @ 54c. ....=	.0540
15% white fine noil carbonized @ 40c. ....=	.0600
15% white fine shoddy @ 30c....=	.0450
Cost per pound...............	$ .2310

Stock mixture for black:

50% fast black cotton @ 12c....=	$ .0600
15% fine black wool @ 54c.....=	.0810
35% fine black shoddy @ 14c...=	.0490
Cost per pound...............	$ .1900

CALCULATIONS.

2,560 ends 4¼ run = 6.00 oz. + 10% weaving take-up ....=	6.60 oz.
65" X 42 picks = 2,730 — 4½ run = 6.06 oz. + 10% weaving take-up ....=	6.66 oz.
Loom weight	13.26 oz.
Finished weight 11½ oz.	
6.60 oz. white yarn + 6% waste allowance = 7.21 oz. @ $.2310 per lb. ....=	$ .1041
6.66 oz. black yarn + 10% waste allowance = 7.40 oz. @ $.1900 per lb. ....=	.0879
Cost of stock	$ .1920
Manufacturing cost: 42 picks @ $.0088 ....=	$ .3696
Mill cost	$ .5616

Warp pattern:
2. White 4¾ run, right soft twist.
2. Black 4¾ run, right soft twist.
2. White 4¾ run, right soft twist.
1. Black 4¾ run, right soft twist.
1. Lavender fancy 4 run, right twist.
1. White mercerized cotton 2/26s.
1. White 4¼ run, right soft twist.
2. Black 4¼ run, right soft twist.
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2. White 4¼ run, right soft twist.
2. Black 4¼ run, right soft twist.
1. White 4¼ run, right soft twist.
1. White mercerized cotton 2/26s.
1. Lavender fancy 4 run, right twist.
1. Black 4¼ run, right soft twist.

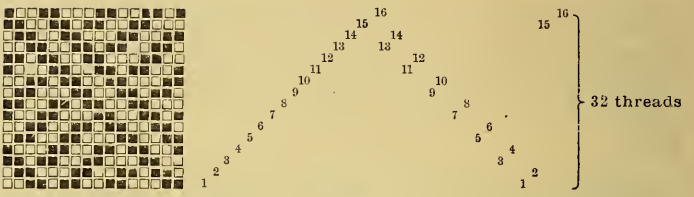
64 threads in pattern
5 patterns.

320 threads in section.
8 sections.

2,560 ends.

Filling pattern:
1. white 4½ run, right soft twist.
1. Black 4½ run, right soft twist.

42 picks per inch.



MELTONS

Some one has said that meltons are made in the finishing room, and in a sense this is true, as in this fabric a great deal depends upon the correct handling in that department, but in order to get a proper foundation for the finisher to produce the right fabric and handle, there must be a proper cloth structure and also an intelligent selection of the stock.

If these two essential things are not right, there is no known process of finishing that will make a good melton, but given the right blend of stock and a proper cloth construction, then a good, practical finisher who understands the handling of meltons, will have no difficulty in producing the goods.

Unless a melton cloth is properly constructed, there is bound to be serious trouble in the finishing. It requires a great deal of fulling to get the necessary close felted face, and it is only by a heavy shrinkage, both in length and width, that you can get this close felt on the goods, and it is owing to this heavy shrinkage that great care and practical experience is necessary in order to make a properly constructed piece of goods.

First of all, there has to be the right selection of stock, and a blend which will full readily and felt into a close face. The blend requires a proportion of fine, medium-length staple, also a short, fine wool, so that it may knit more closely and firmly together in fulling. Stock must be free from burrs. Carbonized wools are always the safest to use, and if properly handled in carbonizing, it will not detract from its fulling properties.

Yarn Sizes.

Second, the yarns must be of the right size in their relation to the weave and the weight of the finished goods; also the number of ends per inch must be considered, because if the size of yarns used is not in the proper proportion to the number of ends per inch, that is, if there are more ends per inch for the warp and filling than will be side by side in one inch when the goods are fulled, then there is more danger of fulling mill wrinkles in the pieces, also in heavy-weight, low-grade goods there are apt to occur "splits" or "cracks," as they are called in England. These cracks will occasionally develop in any heavy fulled cloth through lack of moisture when the pieces are almost up in width, but the chief cause is too heavy setting in the warp ends. When the limit of compression is reached, and an endeavor is made to force the goods an inch or more narrower, the cloth will get so stiff and hard that "splits" are almost sure to appear. As mentioned above, this applies more to the low-grade, heavy-weight goods.

There can be quite a latitude allowed in all heavy felted cloths, as the yarns when felted together will allow of considerable compression. The fibres of one thread will mingle and felt together with another thread, both

in warp and filling, and thus it allows of a heavier setting than would be the case in other goods. There is a limit, however, beyond which it is not safe, and if the finisher endeavors to force the fulling, these "splits" are almost sure to develop, and the finisher will usually get all the blame for the damaged goods, when in reality it is caused by faulty construction of the fabric. Not every piece that is set too heavy will develop these "cracks," as the amount of moisture and the temperature of the pieces in the fulling mill may be in such perfect condition that they will full to the required width without developing "cracks," but there is a latent element of danger in too heavy setting that will cause such damage to which all designers and superintendents should give special attention and see to it that all such heavy fulled cloths are constructed so that there will be the least possible danger of damages occurring in fulling. An ounce of prevention is better than a pound of cure, and there is no cure for a piece full of "mill cracks."

There is a wide range of weights in melton cloths, running from 13 to 22 and 24 ounces and even up to 32 ounces per yard, and this article will consider the practical points of manufacturing a light, medium and heavy weight melton cloth, giving a layout of each.

13-Ounce Melton.

Here is the layout of a light-weight melton which has been used a good deal for fine spring coatings made in Oxford and Cambridge greys, also in various shades of piece dyes.

2,880 ends.
12/3 reed.
80" inside list. plus 2" for listing = 82" over all.

Warp yarn:
4½ run, right twist.

Filling yarn:
6 run, left twist.
Draw straight on 8 harness.
Weave plain cloth.
44 picks.

CALCULATIONS.

2,880 ends 4½ run .....=	6.40 oz.
82" × 44 picks 6 run.....=	6.00 oz.
Plus 6% .....=	0.75 oz.
Loom weight	13.15 oz.

To finish this cloth 13 ounces per yard it will have to be fulled in length to hold at least 16 per cent. Let us now analyze this construction and see if it will allow of the necessary shrinkage in fulling without coming too near the danger limit.

2,880 ends fulled to 55 inches inside list. = 52.4 threads per inch.
44 picks fulled up 16% in length = 52.4 threads per inch.

The warp yarn 4½ runs = a diameter of 1/85 of an inch.
The filling yarn 6 run = a diameter of 1/98 of an inch.

The mean diameter of both warp and filling will be 92, which means that 92 threads will lie side by side in one inch without being compressed. As this cloth is woven plain weave, it will allow of 46 threads warp intersected with 46 threads filling per square inch when finished, and as the cloth construction shows that there are 52.4 threads warp and filling per square inch, you will see that before the cloth can be fulled up to 54 inches in width and 16 per cent in length there must be a compression of 12½ per cent on the yarns.

Let us again figure it another way: 2,880 ends warp divided by 46, the number of threads of 4½ run warp and 6 run filling, can be woven into a plain cloth weave without undue compression. As a matter of fact, it would not be possible to weave woolen yarns of these sizes so closely together, but that is the number of threads which can

be laid side by side in one inch. 2,880 divided by 46 equals 62 6-10 inches in width that the cloth would be without any compressing or felting together of the yarns. The cloth is to finish 55 inches inside of list. 62 6-10 inches minus 55 inches equals 7 6-10 inches of compression or felting to be put into the piece, which is equivalent to 12½ per cent, and is about all that would be safe to attempt in a plain weave. If it were a weave with fewer intersections it could be fulled up a good deal more without any danger. This piece of goods as laid out will take almost a whole day in fulling to get it up to the required width.

The Wool Used.

In making yarns for this cloth it is necessary to get the very finest quality of pulled wool for the white percentage of the mixture, and in laying down the blend in the picker room, a 5 per cent white mixture is somewhat difficult to lay down evenly, so that the mix will be uniform throughout. The best method is to take 20 pounds of the body shade and lay it down in a thin layer on the floor, then take the 5 per cent of white and spread it over as evenly as possible, then run it all through the mixing picker twice. By this method you get 25 per cent of the blend to mix with the other 75 per cent, which is not a very difficult task. This will give a nice, even blend.

In making a 1 or 2 per cent mix it is best to lay down 9 pounds of the body color with the 1 per cent white, and run that through the mixing picker twice. Then add to that another 20 pounds of body color and mix it as before, adding to it the balance of the percentage of body color. By this method you are practically sure of getting an even mix in your batch. Warp yarns should be spun with a good firm twist, as a plain weave is usually hard on the yarns. The filling yarn is given a medium twist.

When woven, the pieces must be carefully burled and all knots removed. The burling tables should be covered with tin or zinc, which makes a smooth surface, and all knots are readily detected by the burlers when they pass their hands over the cloth. It is best to give a double burling, once over a table and once over a perch, where the operator can look through the piece toward the light from a window.

It requires a good body soap to full these goods, and of sufficient alkali strength to saponify all the grease and keep all grease, dyes, etc., in suspension during the process of fulling. The pieces will require considerable attention during the fulling, and should be overhauled frequently to prevent mill wrinkles. When the pieces are about 58 to 59 inches in width, and shrink in length about 14 per cent, take them out, scour thoroughly and extract. Then put them onto a wet gig and give them a few runs on the face. This will loosen up any long fibres not felted down, then put on the shear and crop without drying, shearing off all loose fibres, but leave the close bottom nap or felt. Put back in fulling mill and full up to 55 inches inside list, and the necessary shrinkage in length. Some finishers prefer to dry the goods previous to cropping, and while it is not necessary in regard to the finish, it has an advantage if the goods have to lie over any time before the second fulling. After the second fulling is completed, wash out yarn, using ammonia in the soap bath to insure a thorough raising and washing out of all the soap. Extract and brush yarn on wet brush. Dry at 56 inches, inside list. Steam brush before shearing, giving several runs on shears. Press firm, and leave on roll over night.

22-Ounce, High-Grade Melton.

Let us now consider the structure of a heavy-weight melton made from all fine wool with no adulteration. This layout and weave have been in the market for many years as a standard high-grade melton overcoating, and as the weave is a double cloth in the warp, with a single cloth filling,

it is possible to put a good many more ends in the warp per inch than in the filling. The maximum ends per inch in warp are 72, without any compression in fulling, and 56 per inch in filling. The yarn calculation shows

4,800 ends.
4 run, right twist.
15.4 reed.
80" inside list. plus 2" for listing = 82" over all.

4½ run filling, left twist.
50 picks per inch.
Diameter of warp yarn = 1/80 of an inch.
Diameter of filling yarn = 1/85 of an inch.

that this cloth will come from the loom 23¼ ounces per yard, and as it will lose at least 20 per cent in fulling and scouring, the piece will have to be fulled up 6 inches per yard, which equals 16 2-3 per cent in length.

Formula to find shrinkage:
Multiply loom weight by the per cent clean weight; multiply by 36" (yard); divide by ounces wanted, which will show the shrinkage wanted per yard.

In this case the loom weight is 23.25 ounces, and is estimated to lose 20 per cent of weight in finishing; 20 per cent of 100 equals 80 per cent clean weight.

Formula:

$$\frac{23.25 \times 80 \times 36}{22 \text{ oz.} \times 100} = 30 \text{ inches.}$$

This means that there must be a shrinkage of 6 inches per yard.

Structure analysis:—4800 ends divided by 54 inches finished width will equal 88 warp threads per inch, and 50 picks per inch woven, and shrunk in length 16 2-3 per cent will be equal to 60 picks per inch finished, and as stated previously that 72 threads is the maximum warp and 56 picks in the filling, it shows that there must be a compression or felting together of the warp threads of 18 per cent, and in the filling 6 2-3 per cent. Figuring it by the second method as outlined in the 13-oz. melton, we find that there has to be 12 2-3 inches of compression or felting in the width, and as the cloth is double warp, that is a face warp and a back warp, there will be no trouble in fulling to the required width. If you examine the weave chain, you will note that the filling goes under three threads and over three of the warp, showing an open weave which allows of considerable fulling in width.

Face weave.

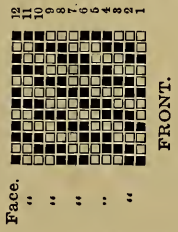
3 harness twill.
Warp face.

Back weave.

3 harness twill.
Filling face.

Cloth woven twill to right.

The weave for 22-oz. Melton.



Manufacturing and finishing particulars same as the 13-oz. melton.

32-oz. Fine All-Wool, High-Grade Fabric.

This layout is a standard fabric made by one of the finest worsted and woolen mills in the country, whose cloths have always been held up as par excellence in fabric and finish. The aim of this mill has been to put on the market a melton cloth equal to the famous Carr melton, which stands at the head of the melton cloths in England. This cloth shows a large number of ends, and is set wide in the loom, necessitating a long fulling. The construction is somewhat different from the usual way, in that the filling

yarn is spun ½-run heavier than the warp yarn, while in almost every other case the filling is spun finer, and is generally accepted as being the best method of construction. The reason for reversing the usual method was the desire to put into the filling stock quite a percentage of fine Australian noils to produce an extra heavy felt on the goods. If the filling had been spun finer it would not have been possible to put in so much of the fine noils, but with the heavier yarn it is permissable, and at the same time there was less twist put into the yarn to retain the necessary strength. The warp yarn was spun from a fine quality wool, with a small percentage of noils, making a strong yarn, which was necessary to insure good weaving, as the picks called for were nearly all that were possible to put into the cloth at the loom.

5,320 ends.
14½.4 reed.
91¾" inside list. plus 2" for listing = 93¾" over all.

Warp yarn:
4 run, right twist.

Filling yarn:
3½ run, left twist, spun soft.
60 picks per inch.

Loom weight 32 oz. per yard.
Finished weight 32 oz. per yard.
In order to finish this weight it is necessary to shrink the piece 20% in length.
5,320 ends ÷ 54" finished = 98½ threads per inch finished.
60 picks + 20% shrinkage in length = 75 threads per inch finished.
4 run yarn = 1/80 of an inch in diameter.
3½ run yarn = 1/75 of an inch in diameter.

This gives a mean diameter of 1-79 per inch, which shows that in a plain weave 39.5 threads warp and filling could be put in a square inch of cloth without undue compression, and as the weave used is a double cloth warp and filling, it will allow of this heavy setting of the warp. At first glance one would say that it had almost reached the limit, and that it would be extra hard fulling in width, but you will see by the analysis of structure that, owing to the fewer threads per inch in filling, it permits of a closer compression of the warp yarns.

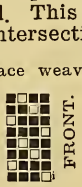
The Finished Cloth.

As above noted, the finished cloth shows 98½ threads per inch in the warp, and the mean diameter of the yarns will allow of 39.5 threads in a single cloth plain weave per inch, which would equal 79 threads in a double cloth weave, while in the filling there will only be 75 threads per inch in the finished cloth, which is four picks under the limit, even without any compression of the threads.

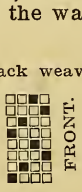
The above will show that the warp yarn will have to be compressed in the fulling 20 per cent, or, to express it in inches, it means 13 1-3 inches of compression or felting in width. If the number of threads per inch in the filling were equal to the threads per inch of warp, it would not be possible to get this amount of fulling on the goods, and it is this fact that permits of the cloth being fulled to the required width.

Note the face and back weaves. You will see that the warp yarns are floated 3 up and 1 down on face, while the back weave is the face weave reversed. This weave allows of the warp yarns lying close together, as the filling intersections are few.

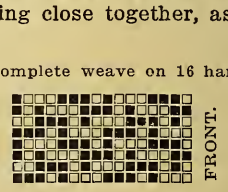
Face weave.



Back weave.



Complete weave on 16 harness.



Weave for 32-oz. Melton.

Manufacturing and finishing particulars same as the 13-oz. melton.

It is possible, of course, to construct a much cheaper grade of melton than these two latter heavy-weight cloths by using shoddy in the blend, and spinning heavier yarns. This would call for a change in cloth structure from a double to a single cloth weave, which will be taken up later.

13-oz. MELTON.

COST CALCULATIONS.

2,880 ends 4½ run warp.....	=	6.40 oz.
82 × 44 = 3,608 6 run filling...	=	6.00 oz.
Plus 6% take-up	=	.75 oz.
Loom weight		13.15 oz.
13.15 oz. plus 8% waste allowance = 14.3 oz.		
Finished weight 13 oz.		
14.3 oz. fine grade wool @ 66c..	=	$ .5899
Plus 16% shrinkage in length...	=	.0943
		$ .6842
Manufacturing cost:		
44 picks @ $.0086.....	=	$ .3784
Plus 16% shrinkage in length...	=	.0606
Mill cost		$1.1232

22-oz. MELTON.

COST CALCULATIONS.

4,800 ends 4 run warp.....	=	12.00 oz.
82 × 50 = 4,100 ÷ 4½ run fill'g	=	9.11 oz.
		21.11 oz.
Plus 10% take-up	=	2.11 oz.
Loom weight		23.22 oz.
23.22 oz. plus 8% waste allowance = 25.27 oz. of stock.		
Finished weight 22 oz.		
25.27 oz. + 16 2/3% shrinkage in length = 30 oz. @ 66c. per lb.	=	$1.2375
Manufacturing cost:		
50 picks @ $.0080	=	$ .4000
Plus 16 2/3% shrink'ge in length	=	.0666
Mill cost		$1.7041

32-oz. MELTON.

COST CALCULATIONS.

5,320 ends 4 run warp.....	=	13.30 oz.
93¾" × 60 picks = 5,625 ÷ 3½ filling	=	16.00 oz.
Plus 10% take-up	=	2.95 oz.
Loom weight		32.25 oz.
Finished weight 32 oz.		
32.25 oz. + 10% waste allowance	=	35.83 oz.
35.83 oz. + 20% shrinkage in length	=	43.00 oz.
43 oz. fine wool and Australian noils @ 66c.	=	$1.7737
Manufacturing costs:		
60 picks @ $.7000	=	.4200
Plus 20% shrinkage in length...	=	.0840
Mill cost		$2.2777

BROADCLOTHS

There are always many varieties in quality and weight of broadcloths, running from the fine worsted warps, 8½ ounces per yard, or even lighter, up to 12 to 14 ounces per yard, 54 to 55 inches wide. The lighter weights are used for dress suitings and opera cloakings, and the heavier cloths for misses' and ladies' spring cloakings and jackets. Of late years the worsted warp goods have been the favorite cloth, as there is a crispness to the worsted yarn that cannot be obtained in an all-wool spun yarn, and this crispness gives a certain character to the cloth which cannot be imitated in the wool spun. There is also the question of weight to be considered, and if any one attempted to spin wool yarns fine enough to make an 8-ounce broadcloth of the same texture as a worsted warp it would be too costly a piece of goods, and then it would not have that distinctive crispness, for by the combing and drawing in the manufacture of worsted yarns it is possible to spin a finer thread out of a given grade of wool than can be done by carding and spinning woolen process.

These worsted warp fabrics require a large number of warp ends, also

more picks per inch than an ordinary wool spun fabric. This fact is generally understood, that the lighter the weight of the cloth the finer the yarn and the more ends per inch warp and filling are required in order to produce a fabric lighter in weight but equal in structure to a heavier cloth. No mill should attempt to make these goods unless it is properly equipped with the necessary machinery for such work.

In order to compete successfully, it should have modern high-speed looms. It is even better if it is equipped with the automatic magazine loom for worsteds, which would make it possible for a weaver to run four looms in place of two of the ordinary looms. The dressing room must have the sizing and drying coils attached to the dressing frames, as these yarns must be well sized to prevent chaffing in the loom. The finishing department should have a crabbing machine, and fulling mills built especially for light-weight goods, as the ordinary fulling mill, built for the general run of woolen goods, is too heavy in the rolls and the cramping boxes are too large.

Delicate Shades.

A manufacturer must also bear in mind that any mill making these delicate shades must be run entirely on white yarns, for if they have any colored stocks running in the carding and spinning rooms, or even dark colored goods going through the finishing room, it would not be possible to keep the delicate shades free from dark colored fly. Mills making such goods have found it absolutely necessary to have a department in the finishing room entirely separated and equipped with all the machinery necessary, which is used only on light and delicate shades. There must be separate nappers or gigs, carbonizing dryers, brushes, shears, presses, etc., as that is the only way to clear shades free from colored fly.

Equal care must be exercised in the dyehouse—special kettles, trucks, extractors, etc., and in some dyehouses the operatives are supplied with clean overalls or aprons. This may be considered by some as an extreme precaution, but the writer can vouch for its efficacy in preventing many soiled spots and stains, as these clean overalls are a constant reminder that the goods are easily soiled and require clean hands as well as clean clothes on the part of whoever is handling them.

Layout for 8-oz. Warp Worsted Broadcloth.

3,680 ends.
13.4 reed.
70¾" inside list. plus 1¼" for listing = 72" over all.

Warp yarn:
1/30s French spun worsted.

Filling yarn:
40 cut, white carb. noils, right twist.

Weave:
3 harness; twill to left.
60 picks per inch.
Listing on extra harnesses.

3 Harness Twill on 12 Harness.

CALCULATIONS.

3,680 ends 1/30s = 3.50 oz. + 6% take-up ..... =	3.70 oz.
72" × 60 picks = 4,320.	
4,320 40 cut = 5.76 oz. + 6% take-up	5.80 oz.
Loom weight	9.50 oz.

Finished weight, 8 oz.

3.70 oz. warp + 2% waste allowance = 3.78 oz. @ $1 per lb.. =	$ .2362
5.80 oz. filling + 3% waste allowance = 6 oz. @ $1 per lb.... =	.3750
	$ .6112
Manufacturing costs:	
2 loom work, 60 picks.....	.2800
Mill cost	$ .8912

A suitable size for the dressing on this work can be made as follows: For 120 gallons of water, 40 pounds dextrine and 80 pounds starch. Place starch in cold water and mix thoroughly free from lumps. Mix the dextrine in four pails of water and boil for twenty minutes, then add the starch to the tank while boiling, also add seven pounds glue, previously dissolved, stirring constantly while adding the starch and glue. Boil 30 minutes, and then add one-half gallon of glycerine.

When woven, these goods must be carefully burled, and any threads left out or imperfections repaired by an experienced mender. They are then run through the crabbing machine, and left on the roll for some time to set, then extracted well, listing tacked together face of cloth inside, and are then ready for the fulling mill.

As previously mentioned, the fulling mill should be a special mill built for light-weight goods, having lighter rolls and smaller cramping boxes. A good body of soap is required, made from tallow and palm oil. Such a soap will make a good felt on the material, and being easy to saponify, will scour out freely. The fuller must examine the prices frequently, opening them out so as to change the folds and prevent wrinkles, and it is a good plan when the pieces are about half fulled to take them out and reverse the ends. Full to 56 inches in width, inside of listings, and cramp 3 inches or more per yard in length. This shrinkage will full out in the gigging and steaming, and allow the goods to be finished woven length.

Do not allow the goods to heat up too much when fulling. Regulate the doors of the mill so that the pieces feel warm, but no more. The longer they full the better pieces you will get, and a closer feel will be found, which produces a superior finish. Scour well, using plenty of warm water to insure the removal of all soap. Then transfer to crabbing machine, roll up tight, and leave on roll all night. Next day carbonize and neutralize.

Gigging or Napping.

The gigging or napping requires care and judgment; a wire napper should not be used. Wet gig with old teasles. Do not use any sharp work, as this class of broadcloths do not need napping so much as lustering. After being gigged the goods should be extracted and cropped, taking off all long fibres, but leaving the fine bottom. Give a few runs to insure evenness, and they are then ready for steaming or lustering. Many finishers prefer the regular steaming cylinders, giving the goods 10 to 15 minutes each end. The writer prefers on this class of goods the old process of boiling and wet gigging, using stiff brushes on the gig instead of the teasels. An up-and-down gig is used, having a trough built under the bottom roll, and so arranged with water and steam pipes that it can be kept full of boiling or cold water as desired. There should also be a perforated pipe placed along in front of the top roll, so that cold water can be forced upon the cloth before it is rolled up. By boiling, wet gigging and cooling off occasionally it is possible to get a good permanent luster on the goods.

Dyeing.

When entering any kind of napped goods into the dye kettle, it is important to see that the direction of the nap lies away from the rolls and not toward them. That is, when the roll draws the cloth out of the dye liquor the nap should lie so that the stream of water will run with the nap. If it were to run against the nap it would rough it up and produce a crimpy or waved appearance. After dyeing, the pieces are taken back to the wet gig to be straightened out, and the nap laid well. Extract and dry at 56 inches. They are then given a final shearing. Steam, brush and press.

As the yarns for this class of goods can all be purchased ready for manufacturing into cloth, the warp yarns on spools ready to set into the dressing frame, and the filling all spun on tubes or bobbins ready to weave, the labor cost of manufacturing is consequently low. There is only the dressing, drawing-in, weaving, finishing and dyeing, shipping and office expenses, and if the mill has part of the preparatory departments, such as carding and spinning, standing idle, because of the yarns being bought for weaving, for all or part of the looms, this fabric should not be

charged up with any overhead expenses or burden of such departments, nor any items which cannot be directly charged against the manufacturing cost of the fabric.

Layout for 10-oz. Wool Spun Yarn:

3,200 ends.
Reed 13.3.
82" inside list. plus 1½" for listing = 83½" over all.

Warp:
6½ run, left twist.

Filling:
7 run, right twist.

Weave:
3 harness; twill to right.
42 picks per inch.

CALCULATIONS.

3,200 ends 6½ run .....=	4.92 oz.
83½" × 42 picks = 3,507 7 run.=	5.00 oz.
	9.92 oz.
Plus 8% take-up .....=	0.78 oz.
Loom weight	10.70 oz.

Finished weight, 10 oz.

Shrinkage in length (finishing) 12%.

This layout was a standard broadcloth for many years until the worsted warp cloth became so much in vogue, but for a medium weight this makes an excellent cloth. It requires a very nice quality of wool to spin down to 6½ and 7 run yarns for two-loom work. Warp yarns should be smooth and level, free from "twists" and bunches, as nothing will discourage a weaver so much as these twists or soft places in the warp yarn, as in either case it means broken ends, and it almost invariably happens that one broken thread will entangle others unless the loom is stopped at once when a thread breaks, and when a weaver is trying to run two looms with twitty yarn it is impossible to see all broken threads in time to stop and prevent a tangle of threads. Few weavers will waste their time on such work, but will seek employment somewhere else where the yarns are good enough to insure a reasonable production and good wages.

This fabric not only requires a fine quality of wool, but also a good felting wool, and a blend of 12-months Texas with a percentage of fine California or fine fall Texas would make a good felting combination. In the foreign wools a good Cape wool is an excellent wool for broadcloths or any felted fabric.

Selection of Wools.

If there is a proper selection of wools there is not so much danger of twitty yarns. Permit me to say here that the carder or spinner is not always responsible for such yarns, as a few long, coarse fibres in the wool will make more twits than carders and spinners ever dreamed of. Carders will occasionally make twitty roping, and spinners will also make twits even when the roping is all right, and it is something that great care should be taken to guard against. There is very often an unfortunate feeling of enmity between a carder and spinner, and the production suffers greatly by it. These two departments are so closely linked together that there should be cordial relations between the overseers, but if any antagonism creeps in between them there is bound to be more or less friction, and if it so happens that the superintendent is not thoroughly practical, and can place the blame where it belongs, the breach is sure to widen, and production will suffer both in quantity and quality.

A cranky carder can make it very disagreeable for a spinner, and a cranky spinner can ruin the work of a good carder if he so chooses. If any friction is known to exist between these overseers the superintendent's duty is to warn both men that if they do not co-operate for the good of the mill, and show it by the results, then one or both should be discharged. Personal animosities between overseers must be at all times subservient to the best interests of the employer, because no business can attain its full success unless it is conducted on the broad principle of

cordial relationship between the heads of departments and the management. These remarks apply generally to the manufacture of all classes of work, and are not confined to the subject of this article.

The roping for the yarns of this fabric should be of such a size as to give the spinner about half draft, and if drawn properly should make a good, smooth yarn. As the warp yarns have to be sized in the dressing, it is not necessary to make a hard-twisted thread. The softer it is the better fabric it will make, as the fibres will felt together better if not twisted too hard, but the twist must be sufficient to make good weaving, and the sizing will prevent any chaffing of the yarns.

Filling Yarns.

In the spinning of filling yarns, keep the top and bottom spools of roping separate. Never mix the bobbins of tops and bottoms for filling in any class of goods, no matter how closely the yarns may reel in size. Follow out this plan in the weave room also, and the finisher will not have to worry over uneven fulling and cockled goods.

Pieces should be tacked at the listing before fulling. This will prevent rolling of the lists. Use a good body of soap made of tallow and palm oil. Do not allow the goods to get too warm in the fulling mills. Keep them just warm enough to full and felt well. If they are too wet when fulling, the pieces will full but will not have that close felt so necessary to produce a good broadcloth, and unless you get the felt the goods will look thready and raw. Full 55 to 56 inches in width, so as to hold 12 per cent shrinkage in length when finished. Scour well and send to carbonizing room.

Gigging.

A wire napper may be used for the first gigging. Begin lightly and do not force the work. Pieces should be reversed after the felt is well broken, and the napping continued until it shows a clear bottom in the goods. Transfer to the cropping shear, and crop until you get down to a close, even nap, then put on a teasel gig for final napping, after which the pieces are ready for the steaming to produce luster. Steam for 15 to 20 minutes each end. The length of time can only be determined by the steam pressure used and the luster desired.

The goods are now ready for the dyehouse. After dyeing, give a few runs on wet brush to straighten out and lay the nap dry at 56 inches. Shear again, so that the nap will not rough up, steam and brush. Dampen with dewing machine and let the pieces lie on roll for some hours before pressing. Give a good pressing, and leave on roll until the next day.

COST CALCULATIONS.

Loom weight of goods 10.70 oz. plus 10% waste allowance....=	11.9 oz.
11.9 oz. fine wool @ 64c. per lb..=	$ .4760
Plus 12% shrinkage in length..=	.0571
Manufacturing cost: 2 loom work, plus 12%.....=	.2600
Mill cost	$ .7931

Weave chain same as the worsted warp broadcloth, but the twill must run to the right.

This weight of broadcloth is generally used for children's and misses' spring or fall coats, also for ladies' cloakings. Some clothing manufacturers will use a 12-ounce cloth, as it can be bought cheaper, but it does not make up so well as the 14-ounce cloth, being more sleazy it does not keep its shape so well. It is dyed into many fancy shades, as scarlet, bright reds, tans, brown, light and dark blues, etc. The stock used is

about the same quality as the 10-ounce cloth, but as the yarns are spun heavier it is possible to use quite a percentage of a fine noil, and a fine California wool may be used instead of the 12-months Texas, which would help to cheapen the stock somewhat.

The manufacturing processes are practically the same as the 10-ounce broadcloth, and as this cloth is 4 ounces per yard heavier, it is even an easier cloth to finish than the 10-ounce. One of the greatest difficulties in making all face-finished goods in the fancy shades is to overcome the tendency to have uneven shades, goods shading from side to centre. If the piece shows darker on the sides than in the centre it will usually be found that the gigging has not been even, owing to the listing being tighter or not so tight as the body of the piece. If it is tight, the gig will dig deeper into the cloth and raise a heavier nap. The same thing will happen if the listing is loose, as the cloth will then flap or strike against the teasels and show a heavier nap, but it will not be so continuous and of as even a streak as a tight listing. Similar unevenness may be caused in the process of steaming the pieces by letting the steam blow out at the listings before it comes through the body of the goods. The finisher should see to it that the steam comes evenly through the pieces, and not have it come first on the edge. This can be regulated by the way that the burlap is wound on the steaming roll, and the finisher should give special attention to the steaming of the first pieces, and if it is not right, have it corrected at once.

Layout for 14-oz. Broadcloth:
3,500 ends.
Reed 7.4.
80" inside list. plus 1½" for listing = 81½" over all.

Warp:
4¾ run, left twist.

Filling:
5 run, right twist.
40 picks per inch.

Weave:
3 harness; twill to right.

CALCULATIONS.

3,500 ends 4¾ run	= 7.37 oz.
81½" × 40 picks = 3,260.	
3,260 ÷ 5 run	= 6.52 oz.
	13.89 oz.
Plus 10% take-up	= 1.39 oz.
Loom weight	15.28 oz.

Finished weight, 14 oz.

Shrinkage in length at fulling 16%.
15.28 oz. + 10% waste allowance = 17 oz. of stock.

Stock mixture:

25% fine Texas @ 60c.	= $ .1500
50% fine California @ 48c.	= .2400
25% fine noil @ 44c.	= .1100
Cost per pound	$ .5000
17 oz. stock at 50c. per lb.	= $ .5312
Plus 16% shrinkage in length	= .0850
	$ .6162

Manufacturing cost:

2 loom work + 16% shrinkage in length	= .2820
Mill cost	$ .8982

Fancy Printed Designs.

This article on broadcloths would not be complete unless mention was made of the fancy printed design broadcloths. The French and German manufacturers turn out very handsome printed broadcloths in very attractive designs which are often sold to the best trade, and the unwary consumer, not knowing the difference between a printed fabric and a fancy wool-dyed broadcloth, is attracted by the design, and the magic word "imported," and pays a big price for the garment. In justice, however, to these printed cloths the writer must confess that he has made exposure tests of a few patterns of good quality, and in the darker combinations the tests were satisfactory, but, of course, not nearly so good as a stock-dyed color. The main thing to guard against in the printed cloth is the low grades made with cotton warp and shoddy fillings, which are dyed with cheap dyestuffs, and which will not stand any exposure tests without fading a good deal.

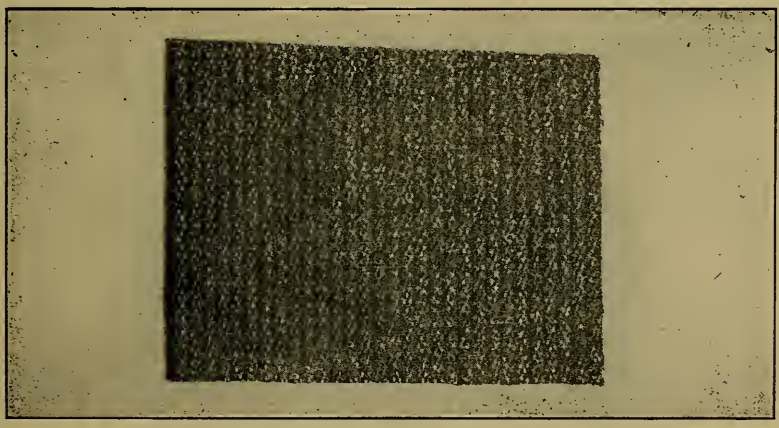
These printed fabrics are woven and finished in the white the same as an ordinary broadcloth, but are usually made from cheaper materials.

The design is printed by rollers similar to the printing of cotton goods. Fancy broadcloths, having a woven pattern, are a semi-piece dye, that is, the yarns which compose the dark threads of the design are dyed in the wool before carding or spinning with a fast dyestuff which will stand the steaming and the cross dyeing. The pattern is woven in the usual way in the ordinary woolen loom. The cloth, after being fulled, napped and steamed, is then dyed like an ordinary piece dye, the undyed yarns of the design being dyed to the desired shade, while the black or dark yarns are but slightly affected by the dyes. This method is not very satisfactory, and the range of designs is very limited.

BEDFORD CORD FOR MEN'S WEAR

Double and Twist Goods.

Bedford cord is used extensively for riding breeches in our cities, and even more so in England, where it is also used by sportsmen for shooting breeches. It is a fabric especially fitted for hard service, as it is strong, elastic, and the hard-twisted face warp yarn gives it the necessary wearing qualities. This cloth is always made with double and twist yarns for warp in contrasted colors, such as drab and white, olive and white and similar tones of color which do not show signs of being soiled or of dust very readily. This is one of the reasons why it has been such a fashionable fabric with both horsemen and sportsmen. These Bedford cords, and, in fact, all fabrics made from double and twist



16-Ounce Bedford Cord.

yarns, are hard cloths to produce perfectly, as the least variation of size in the yarns before twisting will show up very distinctly after finishing. No mill should think of making this class of goods unless it is especially well equipped in the card room. It should also be supplied with good mules, twisters, etc. As the production of these fine yarns in the carding and spinning rooms is necessarily slow, the mill should have extra sets of cards and extra mules if it wants to keep its full complement of looms running. The ordinary carding and spinning equipment which would keep the

looms busy on the average single yarns would not keep more than 60 per cent of them running on these double and twist yarns.

The Card Room.

The card room should also be equipped with balling machines and creels instead of all Apperly feeds throughout, which will make more level yarns. It also requires great care in selecting the wool to produce a nice even eight-run yarn which will spin well and be free from twists. All wools must be carefully sorted and the finest picked out to make such yarns. The term used in England for such a grade of stock is "picklock" wool, meaning that the finest and most uniform locks of wool are selected or picked out of the fleece. Sometimes a fine 1-30s or 1-40s worsted yarn is used for the white thread instead of a wool spun yarn, and by this means the manufacturer is enabled to run more looms than if he undertook to card and spin all the yarns. This would apply to those mills which do not have any extra carding and spinning machinery. In the twisting of the yarns the best results can be obtained by spooling the threads first on spools—1 thread of dark color and 1 thread of white—and twisting from the spools. This gives much better results, the tension on the yarns is more even, and the added cost of spooling is more than made up for by the more perfect twist and also by an increased production from the twisters. After the yarns are twisted it is necessary to inspect all the bobbins, and all irregular or imperfect ones should be laid aside.

Construction of Fabric.

The single yarns for twist are first spun on the mule left twist, and when twisted are made right twist, 22 to 24 turns per inch. Two weaves are here given. In weave No. 1 the lift of the harness is somewhat uneven, being 8 up and 4 down in every alternate pick and the other being 6 up and 6 down. The weave No. 2 shows a uniform lift of 7 up and 5 down. The cloth as illustrated was woven with weave No. 1, as it makes the cleaner cut of the two weaves. The four warp threads which form the cord are woven what is called a warp face, that is, each thread is carried on face over three picks before it is stitched down by the fourth filling pick, each thread being stitched or held down alternately. The cut is formed by two threads single yarn, being woven the opposite of the face threads, while each alternate filling thread floats under the four cord threads, and it is this thread which causes the cord to rise up by the extra contraction in the finishing process. Every alternate filling thread being woven plain, is, therefore, very tightly woven in with the warp threads, and consequently will not contract in finishing as quickly as the thread which floats underneath the cord.

Goods may be fulled in the grease, but it is preferable to scour first and dry. Then have the pieces carefully inspected for threads out or imperfections and knots which should be removed. Imperfections and ends out should be carefully repaired by a competent sewer, then the goods are ready for fulling. Some manufacturers may think that all this extra work will cost too much, but it pays well to have it done before the goods are fulled, as it is often impossible to repair imperfections afterward. An allowance of one-eighth of a yard each on several imperfections will cost more than the extra labor and expense of scouring. Full to 56 inches inside listing, and dry at 57 inches. Steam brush, shear and press medium pressure.

Layout:

4,200 ends.
10-6 reed.
48 picks.
70⅓" inside listing plus 1" for listing = 71⅓" over all.
Straight draw on 12 harness.
2 harnesses extra for listing.

Pattern:

2. 8 × 8 run twist.
2. 4 run single right twist.
2. 8 × 8 run twist.
2,800 ends 8 × 8 run twist 24 turns right + 6% take-up = 4.16 runs ..... = 6.99 oz.

1,400 ends 4 run single right twist ..... 3.50 oz.

10.49 oz.

10.49 oz. warp + 10% weaving take-up .....= 11.54 oz.

Filling:
71 × 48 = 3,408 + 4½ run filling = 7.57 oz. + 10% take-up...= 8.32 oz.

Loom weight .....19.86 oz.
Finished weight .....16.00 oz.

COST CALCULATIONS.

7.69 oz. 8 × 8 twist yarn + 8% waste allowance .....= 8.3 oz.
3.85 oz 4 run single yarn + 6% waste allowance .....= 4 oz.
8.32 oz. 4½ run filling yarn + 8% waste allowance .....= 9 oz.

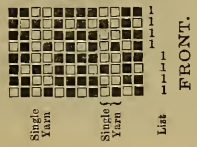
Stock used:
8 run twisting.
Fine picklock wool @ 68c. per lb.
Single yarns.
Fine medium grade @ 56c. per lb.
8.3 oz. twist @ 68c. per lb.....= $ .3527
4 oz. single warp @ 56c. per lb.= .1400
9 oz. filling @ 56c. per lb.....= .3150

$ .8077

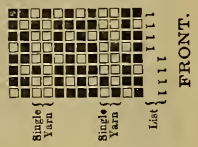
Manufacturing:
48 picks @ $.0082.....= $ .3926
Extra cost, D. and T. yarns....= .0500

Mill cost $1.2503

Weave Chain No. 1.



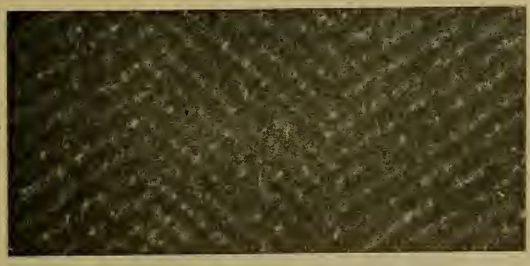
Weave Chain No. 2.



26-OUNCE TWIST OVERCOATING

A comparative cost calculation between an all-wool fabric and a shoddy cotton mix, both having the same design and structure, follows. This is a study in manipulation of fabrics, showing a high-grade overcoating made from pure wool by a mill that never uses a pound of any substitute, and beside this is shown the same fabric structure made by another mill out of shoddy, cotton and wool. The reproduction is so perfect a copy that it would deceive anyone except a cloth expert. Certainly, the purchasing public would not see a difference in the appearance of the fabrics, yet the one cloth costs exactly twice as much as the other. The particulars and cost calculations of both fabrics are given, also photographic illustrations.

This was a case of unintentional piracy on the part of Mill No. 2, which made the low-grade fabric. The mill received the sample from its



26-Ounce Twist Overcoating.

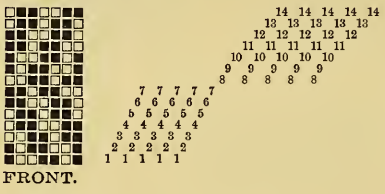
selling agent with instructions to reproduce it at a stated price. The mill did so, not knowing until several months afterward that Mill No. 1, making high-grade goods, was manufacturing the exact style in their all-wool fabric, and the singular thing about it was the fact that the mills were within 50 miles of each other and the owners very friendly.

The selling agent claimed that he received the clipping from a buyer, who stated that it was an imported cloth which he wanted to have copied

into a cheap cloth. It is quite possible that these statements were correct, that it was not a case of piracy but a coincidence of two mills getting hold of an imported fabric through a pattern agency, and both reproducing it in their respective grades. Whether it was a case of piracy or a coincidence, it was a hard matter to convince manufacturer No. 1 that manufacturer No. 2 did not steal his fabric and pattern, producing it in an inferior grade with the intention of underselling him, and the old cordial relations were considerably strained for some time.

Layout and calculations for the all-wool cloth:

2,100 ends, 8½—⅛—¼ in dent.
70½" inside listing plus 1" for listing = 71½" over all.
Draft on 14 harness.
24 picks.



FRONT.

Warp yarn:

2½ run, grey mix., left twist.
3¾ run white, left twist.
Warp yarn twisted 8 turns right twist per inch. 6% take-up in twisting.

Filling:

2½ run black, left twist.
Filling yarn twisted 6 turns right twist per inch. 6% take-up in twisting.

Stock for grey mixture:

10% light blue stain wool, per. lb.. }
40% white fine med. wool..... } 56c.
50% black fine med. wool..... }

White for twisting:

Fine med. wool .....56c.

Black filling:

Fine med. wool .....56c.
2,100 ends 2½ run + 6% take-up in twisting .....= 9.16 oz.
2,100 ends 3¾ run + 6% take-up in twisting .....= 5.92 oz.
71½" × 24 picks = 1,716 2½ run 2-ply + 6% take-up in twisting .....= 14.58 oz.

29.66 oz.
Plus 10% take-up in weaving..= 2.96 oz.

Loom weight ..... 32.62 oz.

Finished weight 26 oz.

32.62 oz. woven weight + 10% waste allowance = 36.24 oz. @ 56c. per lb. .....= $1.2684

Manufacturing cost:

24 picks @ $.0106 .....= .2544
Extra for twisting 32 oz. @ 2½c. per lb. ..... .0500

Mill cost $1.5728

This price could be reduced somewhat by using a percentage of good noil and worsted waste, but, as mentioned before, the mill never used anything but straight wools in all of its fabrics.

26-OUNCE COTTON AND SHODDY TWIST OVERCOATING

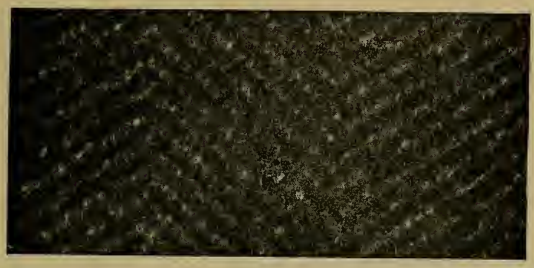
A Comparative Study.

These figures show that the low-grade fabric costs less than half the high-grade all wool, the manufacturing cost being rated the same in both, and the only difference being in the cost of stock. The all-wool stock costs $126.84, and the low grade 48.06 cents, a difference of 78.78 cents a yard.

The manufacturing details are practically the same in both fabrics, but in picking and oiling the cotton mix care should be taken to keep the cotton as free as possible from the oil emulsion, because if cotton gets wet it will cause nibs in carding. A good plan is to pick and oil the wool and shoddy together, then add the cotton in layers, first a layer of wool and shoddy, then a layer of cotton, until the entire batch is laid down, running the lot through the picker twice to insure a good mixture.

The mule draft on the all-wool fabric should be ½ to ⅝, and on the cotton mix about 2-3 draft for the twisting yarn and fully that on the 1¼ run black filling. Previous to fulling, the cotton mix fabric should be given one run on back and two runs on face on wire napper, not to

raise a nap but just scratch it well to soften the cloth. Full both fabrics to 56 inches and scour dry at 57 inches. Brush well, shear off any long hairs, and press cotton fabric very light with the all-wool medium pressure.



26-Ounce Cotton and Shoddy Twist Overcoating.

Layout:
2,100 ends 8½—⅛—¼ in dent.
70½" inside listing plus 1" for listing = 71½" over all.
Draft and weave the same as the all-wool fabric.

Warp yarn:
2½ run grey mix., left twist, soft spun.
3¾ run white, left twist, soft spun.
Warp yarn twisted to right, 8 turns per inch.
6% take-up in twisting.

Filling yarn:
Black 1¼ run, right twist, spun soft.

Stock for 2½ run grey mixture:

10% black cotton peeler comber waste No. 1 @ 11¼c.....=	$ .0113
20% white cotton peeler comber waste No. 1 @ 11¼c.....=	.0225
15% white fine med. wool @ 56c.=	.0840
10% white fine med. noils @ 40c.=	.0400
45% black shoddy @ 13c.....=	.0585
Cost per pound	$ .2163

Stock for 3¾ run white yarn:

40% white cotton peeler comber waste No. 1 @ 11¼c.....=	$ .0450
15% white fine med. wool @ 56c.=	.0840
45% white fine med. noils @ 40c.=	.1800
Cost per pound	$ .3090

Stock for black 1¼ run filling yarn:

25% black cotton peeler comber waste No. 1 @ 11¼c.....=	$ .0281
25% black garnetted waste @ 24c. .....=	.0600
50% black shoddy @ 13c.....=	.0650
Cost per pound	$ .1531
2,100 ends 2½ run + 6% twisting take-up = 9.16 oz. + 10% weaving take-up .....=	10.07 oz.
2,100 ends 3¾ run + 6% twisting take-up = 5.92 oz. + 10% weaving take-up .....=	6.51 oz.
71½" × 24 picks = 1,716 threads 1¼ run = 13.75 oz. + 10% weaving take-up .....=	15.12 oz.
Loom weight	31.70 oz.

Finished weight, 25½ oz.

2½ run grey mixture 10.07 oz. + 15% waste allowance = 11.85 oz. @ $.2163 per lb.....=	$ .1602
3¾ run white 6.51 oz. + 15% waste allowance = 7.23 oz. @ $.0390 per lb. .....=	.1396
1¼ run black 15.12 oz. + 20% waste allowance = 18.90 oz. @ $.1531 per lb.....=	.1808
	$ .4806

Manufacturing cost:

24 picks @ $.0106 per pick.....=	.2544
Extra for twisting	.0250
Mill cost	$ .7600

KERSEYS

It was stated recently in an article on the manufacture of meltons that they were to a large extent made in the finishing room, and while that was true in a sense, it is even more so when we consider the manufacture of kerseys. There is no fabric made of wool in which the process of finishing plays such an important part as in the manufacture of kerseys and broadcloths. These fabrics, although known or classified as two different materials, are really the same. Broadcloths are light and medium weight goods, while kerseys are practically the same cloth

with a heavy backing yarn attached to it to increase the weight, the finishing processes being the same in both cases.

The Better Grades of Kerseys

are usually made in what is known as a double-plain weave, using a large number of ends per inch both in warp and filling. The face and backing yarns are the same quality and counts, and the fabric is called a "through-and-through" cloth; that is it has no backing cloth, and although it is a double fabric, the two cloths are so interlaced that it is as solid as a single woven cloth. These fine-grade kerseys are laid in the loom from 90 to 100 inches in width, and as there is a large amount of fulling, both in length and width, it makes a very firm piece of goods, with a smooth and velvety nap which will not rough up. These high-grade kerseys are often finished in a dull manner, that is without the steam lustering. Some buyers may prefer the dull finish and others the luster.

The medium-priced goods are usually woven with a fine face warp, with a coarser yarn attached on the back, two threads face yarn and one thread backing. There is no back filling. This is a semi-double cloth, and the construction allows of using a cheaper yarn for the back warp. The two face warp threads interlacing with the filling yarn make a firm and closely threaded face, which enables the finisher to get a smooth, well-felted face and to work up a good close nap in the process of napping.

It should be emphasized here that while the manufacture of kerseys in any quality is comparatively easy to the experienced manufacturer, there is many a snag which a man not accustomed to such goods may run against, and which may cause serious loss and also disappointment in the resultant cloth unless guarded against.

A Fine, Good Felting Wool

should be used, along with a fine noil and shoddy, but a fine merino or Thibet shoddy is the best. Many manufacturers use a small percentage of fine Texas and California wools, Australian noils and fine shoddy for the face yarns and a cheaper stock for the backing threads. A standard construction and weave is here given for such goods.

One of the most important things is to secure the services of a finisher who is thoroughly experienced in handling this style of goods, and have the mill equipped with all the necessary machinery for finishing, as so much depends upon the fulling, napping, cropping, steaming, etc., in the finishing process. A good finisher is one of the essentials necessary to success.

It can be said without any fear of contradiction that there is no other cloth made where so much depends upon the proper handling in the finishing as a kersey, and there is no other cloth in which there is so much difference between the raw fabric as it comes from the loom and the same piece after being properly finished. It comes from the loom thready and loose in texture, no luster or life being left in it. It is an unsightly rag of cloth, and to the inexperienced eye it does not seem possible to make an attractive cloth out of it. But let a skilful finisher, provided with the necessary machinery, commence operations on it and it gradually becomes a cloth of beauty and elegance, fit to clothe the most fastidious dresser in the nation. It has firmness and closeness of texture, yet is soft to handle, as smooth as velvet and lustrous as silk. All this change in appearance comes from the action of soap and water in fulling, and the

after processes of napping, cropping and steaming, in combination with the skill and brains of a finisher.

In the Fulling of Kerseys,

or any similar fabric requiring a long fulling, it is necessary to use a good, heavy-bodied soap made from tallow and palm oil, and of sufficient alkali strength to cut the grease in the goods and to hold it in suspension, or, in other words, saponified, during the whole time of fulling. If the soap becomes dead, that is if the alkali contained in the soap is overcome by the grease in the goods or is neutralized by an acid condition of any shoddy in the stock mixture, then the goods will not full, and it will be impossible to get that solidity of cloth and thick, close feel so necessary for a kersey finish. If the soap, through any cause, becomes dead and watery, another piece of similar goods may be run into the fulling mill with the goods already in the machine, which will absorb the excess of water, and then a pail or two of a heavier and stronger alkali soap may be added to the pieces, which will liven up the soap that has been spent, but the safer plan is to take the goods out of the fulling mill and scour off the spent soap, extract and dry, then re-enter the pieces in the fulling mill, and as they are now presumably clean and free from any acids, they can be fulled with a soap that is nearly neutral.

If a pure tallow soap is used it is extremely hard to scour it out of heavy fulled fabrics, some tallow soaps being even harder to eliminate than others, owing to the amount of glycerine left in the tallow. Some soap manufacturers do not extract the glycerine from the tallow, and such soaps are very hard to wash out of the goods. A properly-made soap, containing about 50 per cent of tallow and 50 per cent of palm oil is an excellent soap for kerseys and meltons, or any heavy fulled cloth, and it will scour out readily, unless the water used is very hard and contains carbonate of lime or other carbonates which are very apt to set the soap in the goods, causing uneven napping and cloudiness in the dyeing. Soft water, when it can be obtained, is always the best to use in either the finishing or dyeing of woolen goods.

Soap is very liable to adulteration, and is often mixed with resin, silicate of soda, China clay, excess of water and other ingredients which help to give it weight.

A Few Simple Soap Tests

are here given which may help the manufacturer to determine the quality of the soap he is using. The excess of water can easily be ascertained by reducing a given weight of the soap to shavings and drying them thoroughly until they lose all moisture. The dried weight will indicate the amount of water evaporated, and the difference in weight between the original soap and the dried product will be the amount of water.

If 50 grains of soap is dissolved in a given quantity of water, and then a sufficient amount of diluted sulphuric acid or acetic acid is added to neutralize the alkali, the tallow or grease will separate from the water and float on the top, while the earthy adulterant will fall to the bottom. This grease can be collected, dried and reweighed, and the difference in weight will show the amount of adulteration. Another method of detecting foreign adulterants is to dissolve a given quantity of the soap in alcohol, when all the insoluble foreign matter will fall to the bottom of the test glass.

In the napping of kerseys, soft water, if it can be obtained, is always preferable. The cloth is put on the napper well dampened, as without the presence of water the fibres would break and cause a greater loss in the process. As the object of napping is to raise the interlocked and felt-

ed fibres, straightening them out on the face of the cloth, the other end of the wool fibre being still attached to the body of the cloth, it stands to reason that this can best be accomplished when the cloth is soft and pliable. That water has this effect on wool can easily be demonstrated by the fact that a piece of wet cloth is more easily torn than a dry piece, and the hygroscopic properties of wool are such that a piece of cloth can without even feeling wet hold as much as 30 per cent of its weight of water. This can easily be tested by weighing a piece of cloth as it comes out of the hydro-extractor and again after being dried, when it will be found that the average piece as it comes out of the extractor contains about 30 per cent of its weight of water.

It has been noted by finishers that goods which are not thoroughly clean will not rise on the napper and finish up so well as clean pieces. This has been attributed to the grease in the goods preventing the free access of water to the fibres, and the result is a fluffy and thin nap. It may be noted here that all heavy, fulled goods, after being scoured free from soap, etc., should be rolled onto a

Solid Roll Under Pressure,

just as they come out of the extractor, and left on the roll for 24 hours at least. In England this is called the setting process, and although it may appear to many to be a waste of time, it has been proved by practical maunfacturers that goods so treated will not lose so much in the subsequent processes of finishing, and they will feel much better when finished than the same quality of goods not set on a roll.

The object of napping or gigging is to raise the fibres in such a manner and to such an extent that the surface of the cloth is entirely covered with a fur-like nap. This process was formerly done by a machine called a gig, which consists of a cylinder filled with slats which are closely set with teasels, the burr-like product of a plant. This cylinder makes about 150 revolutions per minute, and it revolves in the contrary direction to that in which the cloth travels, and as the latter moves slowly, it offers a surface of great raising power. The amount of contact between the goods and the teasels is easily regulated by means of a rachet and movable roller. Although the teasel gig is now superseded by the wire napper, in the earlier stages of napping, that is in the "breaking in" of a piece, many finishers claim that in the last process of napping the teasel gig is better than any wire napper, but for the first stages of napping the wire napper is almost entirely used, as it is more effective and does the work much more quickly. All heavy fulled cloths like kerseys and broadcloths are napped wet.

As there is less waste of fibres and the matted and entangled fibres, softened by the water, are more easily combed out, the resultant nap is laid down close to the surface. In the ordinary medium grade of kerseys the napping is usually all done in one direction, as by reversing the nap in goods containing much shoddy it would result in quite a loss of stock, but in the higher grades the nap is reversed, and this produces a thicker body of nap and a superior finish. When the pieces are napped sufficiently they are taken to the cropping shears, still in a wet condition, and the nap is brushed lightly by a revolving brush, which lifts up any long fibres that are cut off, the object being to obtain a close, even nap like a piece of velvet. The goods are then put onto a teasel gig, and the nap is straightened out again and brushed flat before being put into

The Steaming Machine.

The steamer is a machine fitted with two large copper cylinders perforated with many holes to allow the passage of steam and water. The cloth is wound tightly onto one of the cylinders, and steam at 40 pounds

pressure is blown through the cloth for some time, usually 10 to 15 minutes, then cold water is forced through the goods to cool them off. The cloth is then wound onto the second cylinder, thus putting the end of the piece which was outside on the first cylinder inside or next to the cylinder in the second steaming. Steam is then blown through, as in the first case, and followed by the cold water. This steam boiling and cooling sets the cloth and imparts to it a good luster. The goods are now ready for the dyeing process, being run in the kettles from 8 to 12 pieces to a kettle, care being taken to run the pieces so that the water will be shed from them in the direction that the nap is laid.

The Dyeing Process.

The drying process is usually done on a machine heated by steam coils, the cloth being run onto a link chain provided with fine steel pins set about ¼ of an inch apart. This chain carries the cloth through the machine backward and forward between the steam heated coils, and delivers it thoroughly dry and tentered to the desired width. Many finishers do not give sufficient care to the drying of the goods, as they do not realize that cloths may be injured by being dried too quickly, especially if the cloth is not sufficiently extracted, and if it has been rinsed off in the washer with a hard water containing lime, etc. If the drying was done by the natural atmosphere not much damage would result from such action, although it would give hardness, but when subjected to an extreme heat, with so much superfluous water, the effect is to scald and bake the fibres, and burn into them the carbonates contained in the water, which no amount of after-treatment can remove. After drying, the goods are brushed, steamed and examined for knots and imperfections, sheared again, brushed, sprayed and pressed.

Layout for 30-oz. Medium Grade Kersey:

Face 2,880 ends.
Back 1,440 ends.
Reed 9.6.
80" inside listing plus 1½" for listing = 81½" over all.

Dressed:
1 end face yarn, 3¼ run, right twist.
1 end backing yarn, 1½ run, right twist.
1 end face yarn, 3¼ run, right twist.

Filling:
2¾ run, left twist.
36 picks.

CALCULATIONS.

2,880 ends 3¼ run warp = 8.86 oz.
+ 10% take-up .....= 9.74 oz.
1,440 ends 1½ run warp = 9.60 oz.
+ 10% take-up .....= 10.56 oz.
81½" × 36 picks ÷ 2¾ run = 10.67 oz. + 10% take-up....= 11.73 oz.

Loom weight ..... 32.03 oz.

Finished weight 30 oz.
Shrinkage in length 16% (finished).

STOCK MIXTURES.

Face warp:
40% fine wool @ 50c.....= $ .2000
20% fine noil @ 42c.....= .0840
40% fine shoddy @ 20c.....= .0800

Cost per pound ..... $ .3640

Backing warp:
25% fine wool @ 50c.....= $ .1250
75% fine shoddy @ 16c.....= .1200

Cost per pound ..... $ .2450

Filling:
35% fine wool @ 50c.....= $ .1750
65% fine shoddy @ 20c.....= .1300

Cost per pound ..... $ .3050

9.74 oz. face warp + 15% waste allowance .....= 11.45 oz.
10.56 oz. back warp + 20% waste allowance .....= 13.20 oz.
11.73 oz. filling + 20% waste allowance .....= 14.60 oz.

Stock per woven yard..... 39.25 oz.
11.45 oz. face warp @ $.3640 per pound .....= $ .2605
13.20 oz. back warp @ $.2450 per pound .....= .2021
14.60 oz. filling @ $.3050 per pound .....= .2783

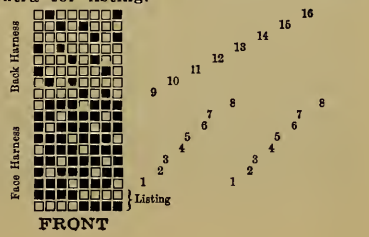
$ .7409

Cost of stock, plus 16% loss in length .....= $ .8820

Manufacturing and charges:
36 picks @ $.0094 + 16%.....= .4000

Net mill cost $1.2820

Weaving chain and draft on 16 harnesses 2 extra for listing.



RATINÉ CLOAKING

18½ to 19 Ounces.

Ratiné fabrics for dress goods, cloakings, etc., have been very popular for some time, and almost any cloth having a rough, lumpy surface has been sold as ratiné. The fabric here illustrated has been called one of the best worsted filling ratinès in the market, being made from a pure luster worsted filling, so-called spiral twist. This is an easy cloth to make and can be made in any mill having broad looms. The only difficult stage of manufacture is in the fulling of the goods, and great care must be exercised to prevent uneven curl effects such as mill wrinkles. If once these are formed, it is impossible to get them out again, and the pieces are a "poor second."

These mill wrinkles are irregular streaks running lengthways, and are usually caused by running the pieces too long in the filling mills without opening out the folds. Unless the goods are opened out, when filling they form into folds or creases, and the pressure of the rolls will soon develop these wrinkles, and no amount of after-work will take them out. If noticed as they begin to form, take the piece and snap it out, in order to change the folds or creases, and it is a good plan to reverse the end of the piece in the mill, which will tend to prevent any further formation of wrinkles. If the goods are too dry in the process of fulling, it has a tendency to cause wrinkles. Have just enough soap on the pieces so that when you take hold of a piece and wring it hard, the live soap will readily show up on your hands.

Another very

Essential Feature

in the manufacture of this class of goods is to give strict attention to the direction of the twist in the yarns. You will notice in this layout that the yarns are made twist to the right, while the twill weave runs to the left. If the twill was woven to the left, the curl would not show up so well on the face of the goods, and stripe effects are made by weaving herringbone twills, one twill showing up the curl more distinctly than the other. Stripes are also made by introducing cords in the warp by weave effects. Very good ratiné cloths are also made with cotton warps with one pick of woolen yarn spun soft and one pick of the worsted yarn.

In this cloaking fabric the warp yarn is made from medium wool combined with mill waste or shoddy, carded and spun natural color as the cloth is piece-dyed. The filling yarn is a No. 6 worsted spun soft, left twist made from imported Lincoln wool and twisted to right a few turns per inch on the twister machine. When this yarn is fulled the worsted will curl up into small loops or curls on the face of the goods. These goods are set open in the reed so that they will full readily. The curl effect is produced by the filling and the open setting of the warp yarns. If we were to take the same yarns and weave another cloth, set closer in reed and having less filling, the result would be entirely different.

It is almost hard to believe the effects that can be produced in cloth by the finishing process, one of the best instances being an ordinary broadcloth, which, as it comes from the loom, is thready and unsightly, measuring about 90 inches in width, and if placed alongside of a finished piece, no one but a practical man would recognize the least resemblance between them. The one raw, thready and loose; the other, lustrous, velvety and smart, yet the change is effected solely by the amount of fulling, napping, steam boiling and cropping. The quality of the water also has a great deal to do with the finish of the cloth, more especially in fine woolens and worsted goods, as any impairment in the quality is more readily detected on fine goods, but whether the manufacturer is making

fine goods in fancies or cheap piece-dye goods, it is necessary to have a good supply of pure water in order to remove all impurities, such as oils, dyestuffs from the goods, and to obtain a bright, smart appearance.

If possible, all water used in finishing should give a good lather with soap. This is one of the most essential qualities, and when it possesses this quality it is known as "soft water." Hard water is due to the presence of lime and magnesia salt, which decompose soap and destroy its cleansing properties. The degree of hardness is usually reckoned by what is known as Dr. Clark's soap test, which is made by dissolving curd soap in alcohol and making it of such strength that 32 decimeters (a decimeter equals 10 grains of water) will produce a lather when added to 1,000 grains of water, prepared by dissolving 16 grains of calcic carbonate in a gallon of distilled water.

The soap solution is now poured from a decimeter bounette into a bottle containing 1,000 grains of the water to be tested, which is occasionally agitated, and the soap solution is added until a lather is obtained which remains unbroken all over the surface for several minutes. The degree of hardness can now be reckoned by Dr. Clark's table, as follows:

Soap test. Decimeter measures required.	Degree Hardness.
1.4	0
5.4	2
9.6	4
13.6	6
17.5	8

From this table it will be seen that a sample of 1,000 grains of water which requires 9.6 decimeters of the soap solution to be added before a lather is formed is 4 degrees of hardness. When water is over 6 degrees it is known as

Hard Water

and is unfit for scouring purposes until it has been softened by the addition of some chemical such as an alkali, preferably potassium in some form, or the introduction of ammonia in the scouring bath. The thin scum which shows on the surface of such hard waters when treated with soap is composed of calcium and magnesium stearates. This greasy paste so adheres to the surface of the cloth that it is hard to thoroughly free it, unless ammonia is added to the bath, and every mill which has hard water should always use ammonia in the scouring bath or overcome the hardness of the water by previous treatment.

The writer would recommend all manufacturers to have a test made of the water by any of the textile schools in their neighborhood, and if the proper means are taken to remove any hardness of the water it would save them a great many barrels of soap every year, as many millions of pounds of soap are wasted every year by using hard water for domestic and manufacturing purposes. In the finishing of this ratiné cloaking, use plenty of warm water when rinsing the soap off in first scour, then add more soap to the washer, with a liberal amount of ammonia, which will thoroughly saponify the soap, making a good lather, and will bring the goods out lofty and bright in luster.

This cloth is dyed in a

Variety of Colors.

black, blue, various shades of browns and olives, fawns, also fancy shades for misses' coats. Full to 56 inches wide, scour, extract, and piece-dye to shade. Dry to 57 inches, steam and brush slightly to lift any coarse hairs on face and shear off, but see that the blades are set high enough so as not to cut the curls off. Press very light, and steam on face afterward to soften the curl. Goods to finish loom length.

Layout:
1,000 ends.
Reed: 7—2.
71" over all.
20 picks.
Woven 4 harness, twill to left.

Warp stock:

20% medium wool @ 44c.	= $ .0880
40% mill waste @ 8c.	= .0320
40% shoddy @ 10c.	= .0400
Cost per pound	$ .1600

Stock for 5 run twisting thread is fine wool @ 56c. per pound.

Filling:
6s lustre worsted.
5 run wool thread.
Both of the above are twisted 3 to 4 turns per inch.

CALCULATIONS.

1,000 ends warp 1 run = 10 oz.
+ 10% loom take-up .....= 11.00 oz.

Filling:
71" × 20 picks = 1,420.
1,420 threads 6s + 6% take-up in twisting and 1,420 threads 5 run + 10% take-up in twisting = 10.33 oz. + 10% loom take-up .....= 11.36 oz.

Loom weight ..... 22.36 oz.

Finished weight 18½ oz.

COST CALCULATION.

Warp:
11 oz. warp + 15% waste allowance = 13 oz. @ 16c. per lb..= $ .1300

Filling:
7.09 oz. 6s lustre + 10% loom take-up = 7.79 oz. + 8% waste allowance = 8.4 oz. @ 72c. per lb. .....= .3780
3.24 oz. 5 run wool + 10% loom take-up = 3.56 oz. + 10% waste allowance = 3.95 oz. @ 56c. per lb. .....= .1382
$ .6462

Manufacturing cost:
20 picks @ $.0110 ..... = .2200

Mill cost ..... $ .8662

No allowance is made here for cost of twisting the filling yarns, but this cost is offset by the fact that 8.4 ounces of the filling yarn is bought yarn, hence the cost of carding and spinning is saved on that amount.

BLUE MELTONS, GOVERNMENT STANDARD

Although these goods are called kerseys, they are really meltons, both the stock used and the finish being of a melton character, while a kersey is known by the smoothness of the weave, no twill showing, and there is a wide difference in the finish between a melton and a kersey cloth. Both cloths are heavily fulled, and shrunk in length from 16 to 25 per cent, according to weight and quality of fabric, but from this point the finishing processes are entirely different, as the kersey is napped and cropped to get a close, velvety nap on the face, then steamed to produce a luster, none of which processes is used in finishing a melton fabric for the Government. The weave used in all army goods is generally the regular 4-harness twill, the cloth being laid wide in the reed to get the necessary amount of fulling. The pieces are shrunk both in length and width, which knits the fibres of both warp and filling together, adding considerably both to the strength and weaving quality of the goods.

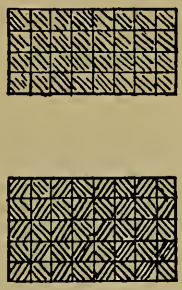
The yarns are always spun with

Opposite Twist,

that is the warp yarn may be spun left twist and the filling yarn right twist or vice versa. This is a common practice in all mills when making any kind of goods requiring a heavy felted face, and the reason for so doing will readily be seen by examining the following diagrams of warp and filling yarns in an enlarged plain weave. It will be noted that when yarns are of opposite twists the twist of the warp and filling threads lies in the same direction as the threads cross each other, and in the process of fulling the fibres interlock with each other more readily, making a smoother and better felted face, whereas in a fabric made

of the same twist warp and filling, the directions of the twist are opposed to each other, and such a cloth will not felt so closely together.

The Government specifications for these fabrics require a strong staple territory fleece wool, grading a good three-eighths quality, and the various cloths call for a specified number of threads per inch in warp and filling, and must be of sufficient strength to withstand a certain



Diagrams of Warp and Filling Yarns.

breaking strain, each of which is noted in the different layouts. All goods must be indigo dyed in the wool, no adulteration even of waste being allowed, and this standard is rigidly enforced. The layouts, as given, are not arbitrary in regard to size of yarns. Manufacturers may change the sizes to suit their requirements in manufacturing, but ends per inch warp and filling and strength of goods must come up to the specifications.

Finishing of These Goods

In the finishing of these goods the process is similar to an ordinary melton finish. The width from the loom will vary according to the weight of the goods, but the average width will be about 72 inches inside listing. The pieces should be carefully burled, removing all knots, slugs, etc. Very little sewing is needed if the weaving is well done, as a thread out or a broken pick will not show after finishing, owing to the heavy felted face. The listings should be tacked together face inside. Have a good body soap, made of palm oil and tallow, and as we want a well-felted cloth we must full slowly. Therefore, do not allow the pieces to get too warm in the mills. Endeavor to get the shrinkage both in width and length to come equally together, which will give you a better felt and a firmer handling cloth. It should take from four to five hours in the fulling mill to get the necessary shrinkage, which in this case will average fully 16 per cent in length.

When fulling is completed, transfer the pieces to the washer and turn on warm water and rinse well. Give a second soaping for at least 20 minutes, and rinse again with warm water, using ammonia or a solution of monohydrate to raise any soap that may still be in the goods, then finish the rinsing with cold water which will "set" or solidify the cloth. If the mill has the necessary facilities, it is a good plan to roll the pieces on a roll under pressure and let them set for 24 hours before being taken to the carbonizing room. This will feed the cloth and improve the handle.

Carbonizing These Goods.

In carbonizing these goods the acid liquor should test at least 5 degrees Baume, and the goods should lay in the liquor from 15 to 20 minutes, after which they are run through the squeeze rolls and extracted.

The temperature of the baking machine should be 200 degrees, which will carbonize all vegetable matter in the goods. Pieces should now be run through a dry fulling mill, which beats out all the carbonized vegetable matter, after which they are neutralized in an ordinary washer by giving them a few minutes run in warm water, then adding a good, strong alkali water testing 4 or 5 degrees Baume, say three pails of this alkali solution to each piece in the water. Test with litmus paper to make sure that the acid is neutralized, and, finally, rinse for 20 minutes with cold water. Extract and dry at 58 inches inside listing. Shear lightly on back and give them three runs on face, but not too low, as the felt is wanted on face. Give a good steam brushing, speck if necessary, and press heavy. Before pressing run on dewing machine, and let lie a few hours to allow the moisture to penetrate the fibres. After pressing, let goods lie on roll until next day.

16-OUNCE BLUE KERSEY.
Government Standard.

Cloth test per square inch:
Warp, 50 lbs.
Filling, 45 lbs.

Layout:
2,660 ends.
Reed: 8½—4.
78″ inside list. + 1″ for listing = 79″ over all.
List. 20 ends each, 2 run white.

Warp yarn:
3⅝ run, left twist.

Filling yarn:
4 run, right twist.

Weave:
4 harness, twill to right.
46 picks.

2,660 ends 3⅝ run = 7.33 oz. and 79″ × 46 picks ÷ 4 run = 9.08 oz. + 10% loom take-up ....=	18.00 oz.
Listing	.20 oz.
Loom weight	18.20 oz.
18.20 oz. + 5% waste allowance = 19 oz. + 12% shrinkage in length = 21.6 oz. @ 54c. per lb.	$ .7290
Manufacturing costs:	
46 picks + 12% = 54 picks @ $.7600 .....=	.4104
Dyeing (extra)	.0700
Mill cost	$1.2094

Yarns tested when spinning:
50 thread warp, 46 lbs.
50 thread filling, 40 lbs.

18-OUNCE BLUE KERSEY.
Government Standard.

Cloth test per square inch:
Warp, 55 lbs.
Filling, 50 lbs.

Layout:
2,760 ends.
Reed: 9—4.
76 2-3″ inside list. + 1″ for list. = 77 2-3″ over all.
List. 20 threads each, 2 run white.

Weave:
4 harness, twill to right.
44 picks.

Warp yarn:
2⅞ run, left twist.

Filling yarn:
3⅝ run, right twist.

2,760 ends 2⅞ run warp = 9.61 oz. and 3,417 ends 3⅝ run filling = 9.44 oz. = 19.05 oz. + 10% loom take-up .....=	20.95 oz.
List.	.20 oz.
Loom weight	21.15 oz.
21.15 oz. + 5% waste allowance = 22.28 oz. + 10% shrinkage in length = 24.75 oz. @ 54c. per lb. .....=	$ .8353
Manufacturing cost:	
44 picks + 10% = 49 picks @ $.8100 .....=	.3969
Dyeing (extra)	.0800
Mill cost	$1.3122

Yarn tested when spinning:
Warp, 55 thread, 46 lbs.
Filling, 50 thread, 40 lbs.

22-OUNCE BLUE KERSEY.
Government Standard.

Cloth test per square inch:
Warp, 65 lbs.
Filling, 60 lbs.

Layout:
3,000 ends.
Reed: 9¼—4.
81″ inside list. + 1″ for listing = 82″ over all.
List. 20 threads each, 2 run white.

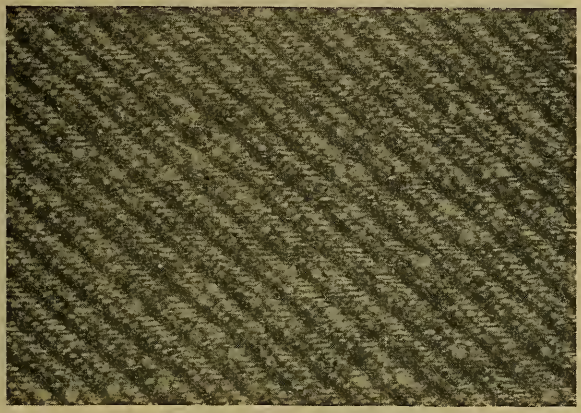
Weave:
4 harness, twill to right.
44 picks.

3,000 ends 2¾ run warp, left twist .....=	10.90 oz.
82 × 44 picks 3¼ run filling, right twist .....=	11.10 oz.
List.	.20 oz.
Loom weight	24.40 oz.
24.40 oz. + 5% waste allowance = 25.68 oz. + 12% shrinkage in length = 29 oz. of stock.	
29 oz. stock @ 54c. per lb.....=	$ .9787
Manufacturing cost:	
44 picks + 12% = 50 picks @ $.8000 .....=	.4000
Dyeing (extra)	.0900
Mill cost	$1.4687

Yarns tested when spinning:
55 thread warp, 50 lbs.
50 thread filling, 48 lbs.

FANCY TWILL KNICKERBOCKER DRESS GOODS

This fabric is made 56 inches wide, 10 3-10 ounces in weight and is used for suits and skirts for women. The warp is a white knickerbocker yarn, and the filling is a dark grey mixture yarn. The white wool used in the warp should be a wool that can be scoured a clean white and then bleached. This includes the white wool nubs. Have the goods come out free from any yellow tinge. This class of goods is sometimes made in a cheaper grade of the same weight per yard by using a percentage of cotton both in the white warp and the dark mixture of filling. The finish is about as follows: Full to 57 inches, scour, extract, dry to 57 inches, shear face, rotary press, and finish 56 inches loom length.

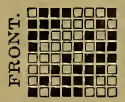


10 3-10-Ounce Fancy Twill Knickerbocker Dress Goods.

Layout:

1,920 ends, reed, 15 × 2 in dent, 64″ + 1″ for listing = 65 inches over all.
30 picks.
8 harness.

STRAIGHT DRAW.



HARNESS DRAFT.

Warp:

1,920 ends, 3¾ run = 5.12 oz.
+ 7% loom shrinkage ..... = 5.48 oz.

Filling:

30 picks × 65 inches = 1,950.
1,950 picks, 3¾ run = 5.20 oz.
+ 4% loom shrinkage..... = 5.41 oz.

Finished weight,	10.32 oz.	10.89 oz.

COST CALCULATION.

Warp:

3¾ run white Knickerbocker ½ draft.
Twist is spun to right.
75% lamb's wool @ 54c. per lb. = $ .4050
25% wool nubs @ 60c. per lb. = .1500

16) $ .5550

An ounce .....$ .0347

Filling:

Dark grey mix., 3¾ run, ½ draft.
Spin twist to right.
100% med. wool @ 45c. per lb. = $ .4500

16) $ .4500

An ounce .....$ .0281

Material:

5.48 oz. 3¾ run warp + 12% shrinkage = 6.14 oz. @ $ .0347.....=$ .2130
5.41 oz. 3¾ run filling + 12% shrinkage = 6.06 oz. @ $ .0281.....=$ .1703

$ .3833

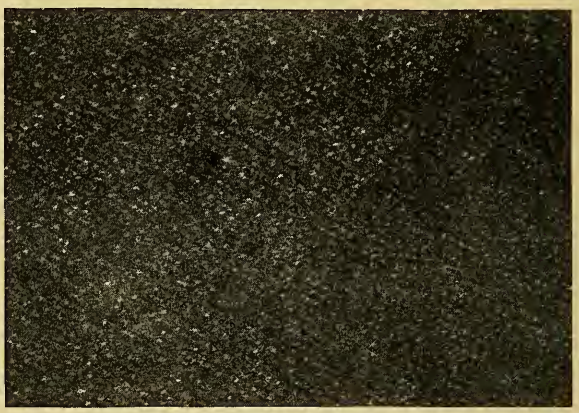
Manufacturing:

30 picks @ .01c..... .3000

Mill cost .....$ .6833

COVERT CLOTH

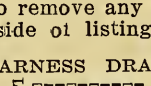
This cloth is used for men's light-weight overcoats and for women's coats. The goods are made to sell at 56 inches wide, and weigh from about 16 to 26 ounces per yard. Great care should be taken in selecting the stock and the blending, so it will card out well and spin a nice, even thread, especially the yarns spun to be used for double twist, which is made by twisting two threads together of different shades, such as white and brown, white and tan, white and black, etc., and any unevenness or lumps in bad spinning will show badly in the goods, in the form of runners and specks on the face. About three-fourths of the yarn on face



16-Ounce Covert Cloth.

is warp, which is the double twist yarn. To eliminate this as much as possible, it would be well to respool the yarn after it has been spooled from the twisting frame, that is, run over an inspecting spooling frame, which runs at slower speed, so that the tender of this frame can take out any defectiv threads or ends that run slack. In this way a more perfect piece of goo can be produced and a better price be obtained in the market, which wi at least pay for the extra expense incurred. To finish this material ful to 56 inches, inside listing, scour, wash, extract, dry to 57 inches, steam brush, shear face close and crop on back to remove any long fibres, and rotary press, not too hot, to 56 inches inside of listing.

HARNESS DRAFT.



STRAIGHT DRAW.

5 harness weave, but use 10 harness, and do not crowd heddies.

Layout:

2,688 ends.
Reed: 10 × 4 in a dent = 67.2" inside listing.
Plus 2" for listing = 69.2" over all.
46 picks per inch.

Warp:

2,688 ends 2/6 run D. T. white and tan..... 8.96 oz.
Plus 10% loom shrinkage 9.85 oz.

Filling:

46 picks × 69.2" = 3,183 picks 4½ run tan.... 7.07 oz.
Plus 7% loom shrinkage 7.56 oz.

Finished weight .....16.03 oz. 17.41 oz.

COST CALCULATION.

Material:

The 2/6 run double twist yarn used in warp is made of 2 ends of 6¼ run, spun ½ draft; twist to right, then twisted together to left, 24 turns per inch, allowing a take-up in length in the twisting of 4% will be the equivalent of 2-ply 6 run yarn. The 4 run filling is spun 2/3 draft; twist to the left.

2/6 run warp.
Fine med. wool @ 64c. per lb., or 4c. per oz.

4 run filling.
75% med. wool @ 50c. per lb.....$ .3750
25% fine shoddy @ 31c. per lb... .0775

16) $ .4525

An ounce .....$ .0283

9.85 oz. + 14% shrinkage .....= 11.23 oz.
2/6 run @ $.0004.....= $.4492
7.56 oz. + 14% shrinkage .....= 8.62 oz.
4 run @ $.0283.....= .2439

19.85 oz. $.6931

Manufacturing:
46 picks @ $.0084.....= .3864

Mill cost per yard..... $1.0795

21-Ounce Covert Cloth.

Layout:
3,360 ends.
Reed: 12½ × 4 in dent, 67.2".
Plus 2" for listing = 69.2" over all.
60 picks per inch.

Warp:
3,360 ends 2/6 run D. T.
white and brown.....11.20 oz.
Plus 10% loom shrinkage 12.32 oz.

Filling:
60 picks × 69.2" = 4,152 picks 4¼ run brown.... 9.77 oz.
Plus 7% loom shrinkage 10.45 oz.

Finished weight .....20.97 oz. 22.77 oz

COST CALCULATION.

Material:

The 2/6 run double twist warp is the same as is used in the 16-ounce covert just described, but white and medium brown, instead of white and tan. The filling is the same stock as is used in the 16-ounce covert, but spun 4¼ run instead of 4 run, and medium brown instead of tan.

12.32 oz. + 14% shrinkage .....= 14.04 oz.
2/6 run @ $.0400.....= $.5616
10.45 oz. + 14% shrinkage .....= 11.91 oz.
4¼ run @ $.0283 .....= .3370

Loom weight ..... 25.95 oz. $.8986

Manufacturing:
60 picks @ $.0070..... .4200

Mill cost per yard.....$1.3186

14 75-100-Ounce Covert Cloth.

Layout:
3,360 ends.
Reed: 12½ × 4 in dent, 67.2" inside of listing.
Plus 2" for listing = 69.2" over all.
54 picks per inch.

Warp:
3,360 ends 2/8 run white and olive, D. T..... 8.40 oz.
Plus 10% loom take-up. 9.24 oz.

Filling:
54 picks × 69.2" = 3,736 picks 5⅞ run olive... 6.35 oz.
Plus 8% loom take-up.. 6.86 oz.

Finished weight ....14.75 oz. 16.10 oz.

COST CALCULATION.

Material:

The 2/8 run double twist yarn used in warp is one (1) thread of olive brown wool, spun 2/3 draft; twist to right; 8⅜ run; and one (1) thread of white, 1/24 worsted; twist to right. The 1/24 worsted is equal to 8½ run woolen. They are twisted together to the left, 26 turns per inch, allowing a take-up in the length in the twisting of 4%, being the equivalent of 2-ply 8 run yarn. The 5⅞ run filling is spun 2/3 draft; twist to the left.

2/8 run double twist
50% fine wool @ 72c. per lb..= $ .3600
50% white 1/24 worsted ⅝ wool @ 84c. .....= .4200

16) $ .7800

An ounce .....$ .0487

5⅞ run filling, med. wool @ 64c. per lb., or 4c. per ounce.
9.24 oz. + 14% shrinkage .....= 10.53 oz.
2/8 run @ $.0487.....= $.5128
6.86 oz. + 14% shrinkage .....= 7.82 oz.
5⅛ run @ $.0400.....= .3128

Loom weight ..... 18.35 oz. $.8256

Manufacturing:
54 picks @ $.7600..... .4104

Mill cost per yard.....$1.2360

IMITATION FURS

Among the many cloaking fabrics offered the present season, none are more popular than the varied assortment of imitation furs. They are made in all grades from the cheapest "dogskins" and "ponies" through the bearskins up to the fine Persian lamb. Some of them are extremely difficult to detect from the genuine fur, while others are obviously poor imitations. The methods of manufacturing these fabrics are capable of division into three general classes, those made on plush looms, knitting frames and those produced on the ordinary woolen or worsted loom. The first division includes the greater portion of the fabrics which require a long pile or nap to produce the desired effect as in "near seals," bearskins and furs of that type. The knitting machine product is largely the various forms of astrachans and Persian lamb effects, and the plain loom is used to produce several types of astrachans and the short-haired furs which may be simulated by the nap capable of being raised by means of the teasel gig or napping machine. The finishing of the pile fabric fur effects has been a specialty confined almost entirely to a comparatively few people in this country. In producing the common caracul cloth finish, the methods have been very much improved in recent years. The method in vogue in France was to crowd the goods into sacks full of wrinkles, setting the crimps by boiling. This method is but little used to-day and has given place to others, which in turn have been replaced by the system in common practice to-day. The use of

Embossing Rolls or Calenders

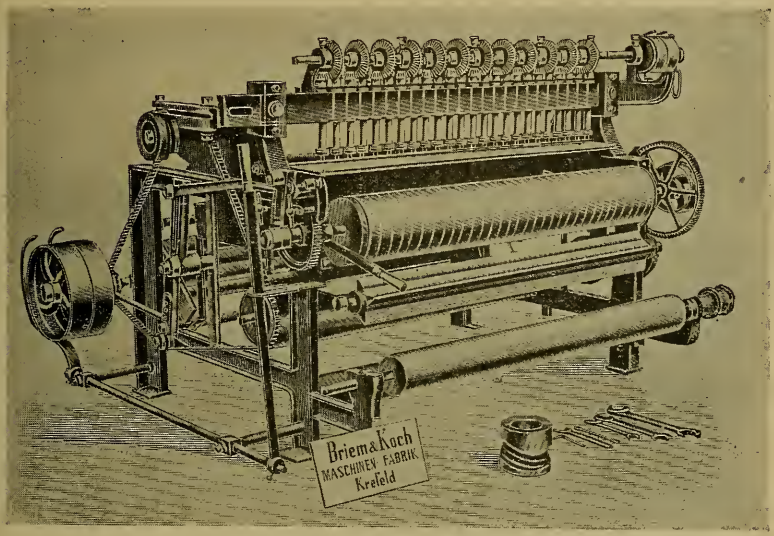
is not advisable, as the back as well as the face of the goods receives an impression, moreover there is the danger of tendering the goods by the cutting action of the rolls, which act as die and matrix. The method of embossing most favored at the present time obviates this difficulty by the use of steam and cold water as the embossing agents instead of heat and pressure. The caracul pattern is formed on a strong cotton fabric by stitching heavy twine in curves that are somewhat irregular all over its surface. The fabric which it is desired to emboss is rolled with the pile next the twine of the cloth containing the pattern. At the back of the cloth is rolled another stout cotton with a plain surface. The three cloths are rolled on a cylinder perforated with a number of small holes which permit of blowing steam or cold water through the goods, resulting in the formation of the pattern in relief on the pile fabric. The present season has for one of its leading novelties for cloakings and children's coats a variety of fabrics in which the distinctive feature is the peculiar laying of the pile by means of brushes revolving in a horizontal plane in contact with the wet pile as the fabric passes through the machine. Machines for producing these effects are offered by English and German builders of textile appliances and a limited number have been purchased by American manufacturers. Several styles of finish may be produced by these machines by means of changing the direction of rotation of the brushes which are independently driven. The machine in appearance is not unlike the multiple spindle boring machine used in many of our wood and iron working plants.

The cut shown here is one of the simple forms of machines adapted more especially for the production of the "pony" and "civet cat" types of imitation furs. Some of the more complicated machines have a double system of brushes, that is a central brush which may be rotated in one direction with another annular brush around it that rotates in the opposite direction, making it possible to produce a variety of very novel effects.

The Small Circular Brushes

are fixed on the lower end of the upright spindle, from which it receives its motion. The fabric here described receives its peculiar appearance from the

action of alternate brushes driven in opposite directions while in contact with the cloth moving over a flat bed, laying the pile to the right and left. By means of suitable levers the cloth may be lowered out of contact, shifted to the right or left as required, raised into contact again, laying the pile in line with the part or "pony back" section preceding it. The imitation of natural skins sewed together obtained in this manner is extremely true to life. The parti-colored effect necessary for the successful imitation of some furs is obtained by various methods. The one in most general use is of the nature of a printing machine. The dye is applied in spots or in a pattern



Whirlpool Brushing Machine

as desired by means of an engraved roll in contact with the pile fabric, which is forced into contact by means of a supporting roller. A similar application of a stripping agent to the fabric results in spots or patterns of light color on a dark ground.

Fabrics suitable for finishing on these machines may be made on the plush loom, true pile fabrics, or on the fancy cassimere loom, these latter cloths having the necessary nap raised by means of the wire napper or teasel gig. A cloth of this type in very good demand the present season is made of stock which is probably unfamiliar to the greater part of our readers. The use of a fibre as coarse and short as that of the cow or calf will be thought an impossibility by many of our carders and spinners, nevertheless it is used and with excellent results in the manufacture of the imitation pony skins of low grade which are a feature of to-day's business with one or two of our large woolen mills. The manipulation of stock such as this would not be readily undertaken by some of our carders, but in actual practice presents no insuperable obstacles. The warps for these cloths are in the majority of instances composed of a coarse, low-grade cotton thread, which is entirely covered in the finished goods by the glossy curls of the

nap produced by the filling which forms the face of the goods. The cloths are of extremely low texture, seldom over twenty-four ends or picks per inch, and produce very rapidly. Their manufacture has been

Confined to Few Mills,

largely because of the cost of installing the necessary appliance for the peculiar finish. Many manufacturers have hesitated to purchase the machine, fearing that it could be used only for this type of work which may not remain in popular favor a sufficient length of time to warrant the expense. The comparative lack of competition because of this timidity has resulted in an excellent business for the few mills equipped to accept orders for this type of fabric. Samples of foreign cloths of this character are in the hands of agents here, and a very satisfactory business has been booked. The layout here given is for one of the cheaper cloths.

LAYOUT.

Warp: 1,360 ends; reed 6½—3 = 69¾" + 1½" for listing = 71¼" over all.
20 picks.

CALCULATIONS.

1,360 ends 2/12 cotton = 4.32 oz.
+ 5% ..... = 4.54 oz.

20 picks ⅝ run = $\frac{20 \times 71.25}{625}$ ..... = 22.80 oz.

Loom weight ..... 27.34 oz.

STOCK MIXTURE.

40% hair @ 6c. ..... = $ .024
60% shoddy @ 14c. ..... = .084
$ .108

COST.

4.54 oz. @ 21c. per lb ..... = $ .0596
22.8 oz. + 20% shrinkage = 28.5 oz. @ $ 108 ..... = .1930

Stock cost ..... $ .2526

Manufacturing, 20 picks ..... = .2000

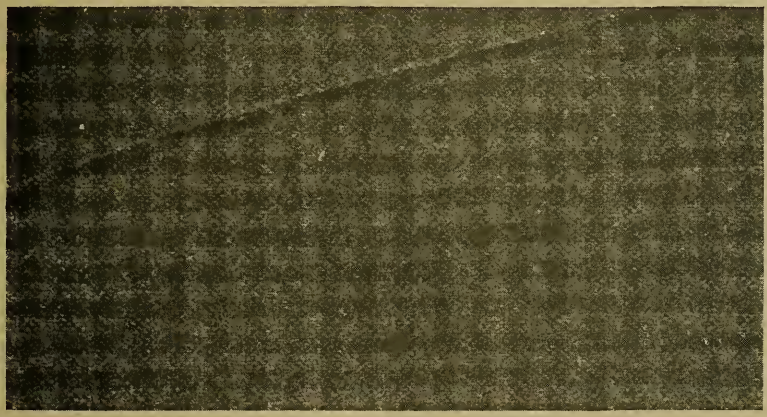
Net cost ..... $ .4526

It may be that the manufacturing cost will appear low on this fabric, but such is not the case. The cotton warps should be purchased on loom beams, which eliminates the entire cost of warp preparation aside from the drawing in. The low number of picks of coarse filling will be a disadvantage to mills not fitted for dealing with yarns of this character. The yarns should be spun on ten or eleven inch bobbins, if feasible, or on the bare spindle, and used in the form of cops to facilitate the weaving, which will require a weaver's attention on the filling most of the time. The warp should run practically with no breakage from end to end, allowing the weaver to take care of the filling with no undue amount of labor. There are a variety of novel effects which may be produced by machines of this type, either on fabrics of the plush order or those woven on the ordinary loom, which may be developed in piece dyes or fancies. For plain stripes an ordinary cylindrical brush is used in connection with a stencil, which governs the width of the stripes.

Another method of producing fancy effects on these goods is by means of cutting the pile to form the pattern desired. This is accomplished on the shear by substituting a blade, of which portions are cut away to correspond with the parts of the pile which are to be left uncut to form the design in relief. A separate knife is necessary for each width of stripe. For the production of diagonals the cloth is fed to the blades at the required angle, and they are then lifted by suitable cams at the end of the traverse. Of all these methods the multiple brushing machine is capable of the most satisfactory results in the hands of a competent and careful workman.

FANCY CASSIMERE

The fabric here illustrated is one that sold in quantities a few years ago, several mills operating their entire equipment in the production of various styles in this construction, a New England mill of over a hundred looms operating at full capacity for nearly three years on the exact fabric analyzed. The popularity of this cloth was due to the extremely fine face appearance, the weave employed for its production, plain or cotton, giving a much closer texture than could otherwise be obtained unless a material increase was made in both ends and picks. The weave used permitted the manufacture of a wide range of patterns while the designer was practically unlimited in the variety of color mixtures used. Many of the styles produced displayed a considerable ability in the formation of mixtures which for harmonious blendings of colors were equal to any produced since either in this country or abroad. Some were of the nature of the so-called heather mixes, presumably so named for their approximation to the colors seen on the hillsides of "Auld Scotland" and never to be forgotten by her sons and



Cotton Weave Cassimere.

daughters. Another type was the so-called "illuminated mixes," made for the most part with a large percentage of a very dark shade with just a hint of bright colors tastefully blended into the mass, which stood out clearly against the dark background, but not strong enough to make the mixture appear crude or inharmonious. The inherent

Difficulty of Producing Perfect

goods with fine yarns in the relatively tight weave needed to give the desired effect deterred many mills from attempting to secure a part of the business, which might easily have been obtained, as the demand was in excess of the production of the comparatively few mills engaged in manufacturing these cloths.

The face warp and filling were made from a nice territory wool, spun to five run for warp and five and a half run for the filling. The back warp was cotton, usually 2-26, but in some instances a single 14 was used. A considerable part of the weight was obtained by the use of a heavy backing filling made from a stock mixture of wool, shoddy and cotton. Wools for the

face yarns should be fine, of fairly good length, well sorted and scoured absolutely clean. The latter item is of the utmost importance, as improperly scoured wools cannot be colored with any degree of success, nor will the finished fabric have the brightness and life of a cloth made from clean stock. The method used in scouring is not of great importance, excellent results being obtained with the old-style soaking vat and rinse box, though the installation of a modern type of wool-washing machine will well repay the outlay, if any quantity of wools are bought in the grease. There is considerable diversity of opinion relative to this question, many manufacturers being firmly convinced that by purchasing grease wools and sorting and scouring them in their own plant they are able to obtain better values than would be possible if scoured wools were bought. Others maintain that for the mill of less than

Fifty to Sixty Looms

it is not economy to do their own scouring. This difference of opinion is due to a variety of causes; proximity to markets and reliable scourers should be taken into account in consideration of the question. That the size of the plant makes no material difference in the policy to be followed is shown by the fact that within a few miles of each other are two mills, one of seventeen looms using nothing but grease wools, while its neighbor with a hundred looms buys scoured wools entirely. The advantage in buying wools in the grease is the fact that grades may be maintained more even and the scouring kept up to a uniform standard at all times. The difference in cost is probably very slight, if any saving is made by the small plant. The selection of the wools for mixture should receive careful attention, as it is essential that they be

Free and Open,

containing no undergrowth or short staple that will card out with difficulty, or possibly refuse to be carded, and roll up, forming minute "pills" that will show in the finished fabric in the form of specks. This is a very serious condition of affairs, as it means, in any case, the employment of extra help in the finishing room to remove the specks with burling irons or selling the goods at prices that will entirely blot out the gain and possibly make inroads on the profits secured from other goods. The carder may be able to relieve the situation somewhat by trueing up the cards, grinding and in other ways putting them into A1 condition. It will probably be necessary to set them closer than would ordinarily be the case, and when all is done the specks may still be present in sufficient numbers to cause much damage. The use of pulled wools for making mixtures is advocated by many of our most skillful manufacturers, their claims of its superiority for this purpose resting on years of experience. In preparing a batch to be colored into light shades select wools that are free from yellow tips or other discolorations, as the tinge of the wool will oftentimes prevent the dyer from obtaining the clearness of shade desired. Stock used for the white should be bleached and the black for the mixtures should be of a decided blue cast, a much better shade of mixture resulting from a blend of such colors. The roving for the face yarns should be made half draft, that is, a reeling of 25 yards of roving should weigh the same as a 50-yard reeling of spun yarn. This will permit of drawing the stock sufficiently on the mules to insure the making of a strong,

Smooth, Elastic Thread.

The idea prevalent among spinners that the strength of the yarn is due to the twist is only half correct. In many cases a change in the drafting will show an increase of strength with less twist than was put into the underdrawn yarn. The backing filling is made from a totally different stock, and will require slightly different treatment in both carding and spinning.

The roving should be made about two-thirds draft, as the quality of the stock will not permit of its being drawn to so great an extent in the spinning. The object to be attained here is not so much strength as a full, round, soft thread that will cover as much as possible the cotton of the back warp. The handle of the fabrics is much improved by giving the backs a few runs on the napping machine. Many manufacturers would consider that goods of this character should

Be Dressed on Two Beams,

one containing the face warp, the other the cotton, as the take-up and elasticity of the threads are so at variance. Actual mill practice has amply proven that in this particular construction the expense of double beam work may be dispensed with, the dressing of both wool and cotton on one beam giving extremely good results.

One of the chief difficulties in weaving is the tendency to form small floats with but little apparent reason. To prevent this, the warp should be woven with considerable tension, every end replaced as soon as the break is noticed, and all knots tied without the long ends so often found as a result of carelessness on the part of the spoolers. The weave used will cause floats more readily than those commonly employed for the production of cassimeres, requiring close attention on the part of the weaver. The goods should be carefully perched, all imperfections marked, details as to length, weight, piece number, etc., entered on suitable blanks, and the goods sent to the burling room. Here the girls are required to raise all knots, back and face, remove slugs, bits of foreign matter and the tangled ends of broken threads or filling that have been drawn in at the sides. The operation of burling, while apparently very simple and

Requiring no Special Skill,

must be very carefully performed on many styles of goods, or much harm may be done. In removing slugs care must be taken not to break the threads next to that in process of removal, and knots must not be broken off too short, lest the ends shrink back during the fulling, making more work for the sewers. In addition to replacing broken ends and picks, the sewers must remove coarse threads, double ends, correct wrong draws, mend floats and put the pieces in as nearly perfect condition as possible before they are fulled, as such work is much more easily performed before the fibres have become felted together. Before the pieces are taken to the fulling mills they should again be perched to see that burling and sewing have been properly done. In the fulling room the pieces should be run into the mills two at a time, given sufficient quantity of a good, full-bodied soap to

Thoroughly Saturate the Goods.

After running a short time they should be examined and tested to see that the soap is working well. The grease and dirt should be well started, then the mills operated with the traps up, as the goods are not to be fulled endwise. With a soap of full body, properly mixed, the fulling should not take more than three to three and one-half hours, when the pieces are ready for the washer.

Run for half an hour in warm water, open the gates and give a thorough rinsing, close the gates, allow a pail of soap to each piece and let them run in a warm lather for fifteen minutes, rinse well and extract. If the goods are to be finished with a soft back they should go to the nappers before drying, otherwise they may be dried directly after extracting. The drying should be carried on at as low a temperature as is compatible with the production, in fact, rather than to hasten the drying by increasing the temperature in the drying chamber, it would be profitable either to operate the dryer overtime or increase the capacity by adding to the drying cham-

ber of the machine. Too thorough extracting, while aiding in the drying operation, is to be avoided, as the goods will not handle as well as pieces which go to the dryer rather damp and dry slowly. From the dryer the goods are taken to the nappers and given sufficient work on the face to raise the nap sufficiently for the shear to give a clean, clear finish, every thread round and full, the pattern standing out with distinctness. Give a thorough inspection, repair all damages which may have escaped notice hitherto, then give a run on the steam brush, and press hard. Steam lightly as the goods come from the press, rolling on a wooden roll, where they should be allowed to

Remain Overnight

before being unrolled for the final perching. It may be thought by some that such care is not required in the manufacture of fabrics containing cotton, but buyers have grown more and more exacting each year, and at the present time expect perfection even in low-priced goods. In many cases goods which would have been satisfactory deliveries a few years since would now be classed as poor seconds.

A less expensive fabric, made from the exact construction used in the one described above, was produced profitably by a Rhode Island mill at an unusually low cost of manufacture. The fancy colors on the face were spun from a fine wool, the ground color, approximately half of the warp and filling, was spun from a stock mixture composed of 75 per cent cotton and 25 per cent wool, with the backing filling made from a mixture of equal parts of good cotton and card waste. This fabric sold well for several seasons, and gave excellent service to the ultimate consumer. The entire manufacturing cost was only thirty cents per yard, considerably under what the average mill would regard as a fair estimate for manufacturing a similar fabric.

LAYOUT.

3,840 ends; 14 reed, 4 per dent = 68.5" + 2" for listing = 70.5" over all.
48 picks.

STOCK.

Face warp and filling all wool @ 52c. per lb. 3¼c. an ounce.
Back warp 2/26 cotton @ 28c. per lb. $ .0175 an ounce.

Back filling 25% wool @ 48c.	=	12c
75% shoddy @ 24c.	=	18c.
Per pound		30c.

$ .1875 an ounce.

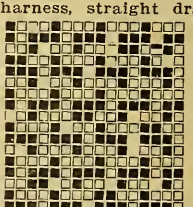
CALCULATIONS.

1,920 ends 5 run = 3.84 oz. + 12½% take-up	=	4.32 oz.
1,920 ends 2/26 cotton = 2.75 oz. + 12½% take-up	=	3.09 oz.
32 picks 5½ run = $\frac{32 \times 70.5}{550}$	=	4.12 oz.
16 picks 1¼ run = $\frac{16 \times 70.5}{125}$	=	9.02 oz.
Loom weight		20.55 oz.

COST.

8.44 oz. wool + 15% waste = 9.93 oz. @ 3¼c.	=	$ .3227
4.12 oz. cotton + 3% waste = 4.24 oz. @ 1¾c.	=	.0742
9.02 oz. backing + 25% waste = 12.02 oz. @ 1⅞c.	=	.2253
Cost of stock		$ .6222
Manufacturing	=	.3240
Total net mill cost		$ .9462

16 harness, straight draw.

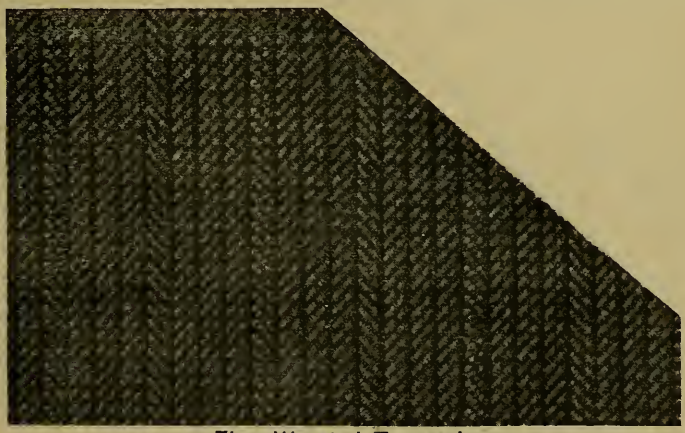


FINE FANCY WORSTED SUITING

The greater part of the men's wear fabrics described from time to time have been those which are manufactured at a popular price and used by the large clothing manufacturers. The sample selected for analysis and description here is of an entirely different character, both in construction and stock used. Such cloths are usually sold through the jobber, and are intended primarily for the fine tailoring trade. The stock selected for manufacturing the yarns here used is an Australian, capable of being spun to 64s or even finer, but in the sample is spun to 40s, making a plump, round, smooth thread, that gives an

Appearance and Handle

to the fabric impossible to secure with any other stock. The yarns are spun on the Bradford system, are carefully inspected and practically perfect when purchased by the weaver. For use in this type of goods the yarns are invariably skein-dyed, the method pursued usually involving the use of a machine of the Ferris wheel type. In this machine the skeins are held at full length by means of sticks resting in sockets on the spiders, and alternately immersed and withdrawn from the dye-liquor. The results ob-



Fine Worsted Trousering.

tained by this method are far superior to those resulting from the use of the old-style hand-tub. When dry the skeins are taken to the winding room and wound to six-inch spools, or, in the most up-to-date mills,

Formed into Cones,

a much more convenient and economical method of handling. The spools, or cones, are then placed on a suitable rack at the back of a spooler, and the yarn transferred to a jack spool for convenience in handling in subsequent operations. In each of these operations it is essential that the operatives tie a knot that will hold during subsequent transactions without slipping. Dressing should preferably be done on a wet frame, as the high filling texture (99 picks per inch) may result in considerable chafing if the warps are not sized. The question as to the sizing compound which will give the best results is one that may be left for each individual mill to decide, as there are circumstances connected with each case that may re-

quire treatment that would not be suitable for others. The size used in any case should be one that is readily soluble in warm water and containing nothing that is in any way harmful to the wool fibre or that will have any effect on the colors used in dyeing the yarns. The use of a suitable warp compressor in beaming the warps is strongly recommended, as in this method of beaming the

Life and Elasticity of the Yarn

is preserved, and a warp made that will give much better results in the way of production and quality of finished goods.

The fixer should have the loom in A1 condition before the warp is hung in, and see that every thread is in its place before starting up. Set the reed in such manner that the warp is in the center of the reed space. Should the reed itself be shorter than the space between lay ends, fill in the space with pieces of reed, as too much space is very likely to cause more or less trouble in the way of throwing the shuttle crooked. See that the reed is perfectly straight and in line with the throat of the box, also that the boxes are in the correct position in relation to the race plate. Have the harness so that the lower shade will clear the race plate nicely, yet not be high enough to throw out the shuttle or cause split bobbins. Adjust the power and sweep straps so that the shuttle reaches the box in good time, but without sufficient force to cause it to rebound. See that the stop motion is oiled and works accurately and that the take-up is pulling over the correct number of teeth, if the ratchet ring type is used. When the heading is woven, an inch or two may be woven with the correct filling, and the

Harnesses Raised One by One

for the detection of threads out, wrong draws, wrong colors or defects of any other nature. If found all right, the harness looker should mark it OK, sign his initials, and the weaver may start his loom. Mills making fine fancy fabrics should have enough competent men to look over the harness on each loom at least twice weekly, as the greater perfection of product secured in this way will well repay the expense involved. When the pieces are taken from the loom they should be perched and measured, then pulled over a table in a good light and every imperfection marked for the sewers, a complete record of the details as to loom number, piece number, weaver, yards, picks, etc., being made on a form provided for the purpose, so that reference may be readily made should occasion require. Burling on goods of this grade must be carefully performed, all knots raised back and face, slugs reduced and slack threads drawn up. The burlers should also be provided with a piece of chalk and instructed to mark any imperfection that escaped the notice of the weave room percher. In this way much valuable time will be saved in the sewing room.

Sewing on fine fancy worsteds requires no little skill. In order to accomplish the best results, the sewers should

Have Some Knowledge of Weaving

and be able to read the chain draft, as at times it becomes necessary to replace a thread in an intricate weave, and it is essential that the system of interlacing warp and filling be known exactly. In addition to sewing in broken threads and picks, the sewers must repair wrong draws, replace hard twist and coarse threads, tight picks or wrong colors, as well as repair floats, holes and other imperfections. After sewing, the goods should again be inspected before passing to the next process, to make certain that every damage which can be repaired has received attention. The pieces may then be taken to the wet finishing and should be carefully scoured with a pure, neutral soap. Harsh detergents of any kind should never be allowed to come in contact with fine goods of any description, and are particularly out of place in the finishing of high-grade worsteds. When thor-

oughly cleansed and well rinsed, remove from the washer, place on the wet brush and give alternate steam and cold water blowings, with the ends of the pieces changed between the operations. Extract in the

Open Width

to avoid wrinkles. This is a very simple process, and may be readily accomplished in any mill with a comparatively inexpensive installation of machinery. All that is required is a suitable roll and means for rotating it at a speed of 800 to 1,000 revolutions per minute. The pieces may be wound to this roll direct from the wet brush. A truck fitted to carry five or six of these extracting rolls should be provided, on which they may be taken to the dryer. A frequent error is the use of too high a temperature during the drying operation. This should be guarded against, as the handle of the goods is very much depreciated by such treatment. Drying in the open air is much preferable to any method of artificially performing this part of the work, but the length of time required and the lack of room for tenter bars sufficient to dry in this way are objections that make it impractical. In default of this, the best substitute is a chain dryer of such capacity that the drying can be accomplished at a moderate heat. When dry, the pieces are taken to the brush, given two or three runs, then sheared,

Lowering the Blade

a notch or two between each run. A very grave mistake is made in attempting to shear too closely on the first cut. After shearing, steam brush, spray and press. The result will be a fabric of which any finisher may well be proud, and that will compare favorably with any made in this country or abroad. Many of the mills making fabrics of this grade put them through a further process, and sell them as "London shrunk." This process may be performed in several ways, one in common use being to roll the pieces in contact with a wet cloth, allowing them to remain until the moisture has entirely disappeared and repressing with a plate press. Another method of accomplishing the same result is to run them between two rolls, the lower, covered with cloth, revolving in a trough of water. The piece is then hung over bars in folds and allowed to dry naturally. The method of finishing here described is somewhat more expensive than the system commonly used, and is more nearly akin to that in use in the foreign mills making high-class fabrics. The extra time and expense involved are well repaid by the

Enhanced Value of the Goods.

The peculiarly plump, kindly handle of the fabrics cannot be developed without an expenditure of time and labor, which probably is not justified in the manufacture of popular-priced cloths. The method of finishing in use in many of the Bradford fine goods mills involves the use of falling stocks, a type of machine practically unknown in domestic worsted mills. They are used preliminary to the scouring, and aid very materially in producing the handle typical of the finest cloths. The statement is often made that domestic manufacturers cannot make fabrics equal in quality and finish to those from abroad. This remark has no foundation in fact, as manufacturers in general do not cater extensively to the fine trade, they having learned by experience that there is more profit to be made in the medium-priced goods which sell in large quantities than in higher-priced materials, which, while they show a larger profit per yard, do not permit of operating a plant on as efficient a basis because of the fact that orders for fine goods are invariably for small quantities involving the making of one and two piece warps with the attendant increase in manufacturing charges.

LAYOUT.

6,480 ends; 16½ reed, 6 per dent = 65½"
+ 1½" for listing = 67" over all.

99 picks.

Dressed:

2/40 light slate.....	3	6	9
2/40 dark slate.....	3	3	6
2/40 black 3			3
			18

18 × 24 = 432
15 sections.
6,480

Filling:

2/40 black 1		1	2
4 run black	1		1
			3

STOCK.

Worsted (warp and filling) 2/40 Australian.
Wool (4 run back filling) ½-blood territory.

CALCULATIONS.

6,480 ends 2/40 = 9.26 oz. + 10%
take-up .....= 10.29 oz.

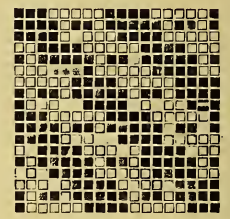
66 picks 2/40 = $\frac{66 \times 67}{40 \times 560 \div 16 \div 2}$ = 6.32 oz.

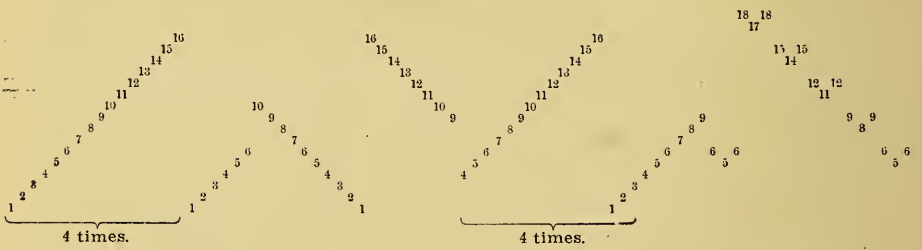
33 picks 4 run = $\frac{33 \times 67}{400}$ .....= 5.53 oz.

Loom weight ..... 22.14 oz.

COST.

16.61 oz. worsted + 7½% waste = 17.95 oz. @ 6¼c.....=	$1.220
5.53 oz. wool + 15% waste = 6.5 oz. @ 3¼c.....=	.210
Cost of stock.....	$1.430
Manufacturing .....=	.554
Net mill cost	$1.984



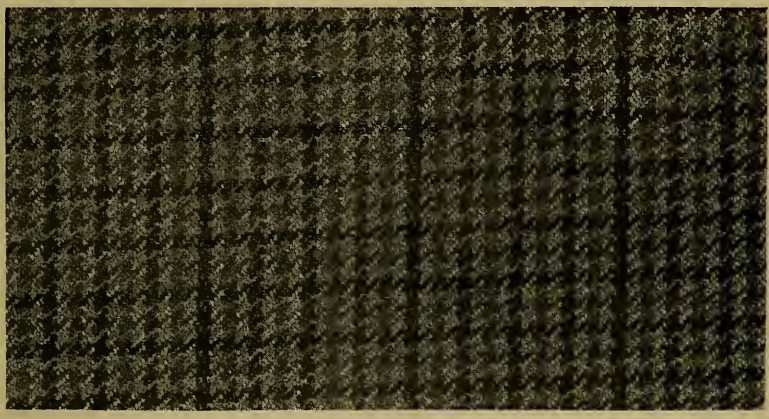


GUN CLUB CHECKS

This type of check has become so popular of late that few lines, either of fancy worsteds or woolens, do not contain one or more books of club checks in various sizes and colors. In fact, they are so generally shown every season that they have really become practically staples, or possibly to be more nearly exact, semistaples. They are made in a great variety of colorings and a wide range of fabrics, from the low-priced manipulated cassimere to the finest Australian worsted. The characteristic of this check is the color arrangement of the pattern, which invariably consists of three colors arranged light, medium, light, dark, as in our illustration, forming a check within a check.

For men's wear cloths the patterns are usually dressed with either two, four or six threads of each color on the face in each pattern, but for ladies' wear, either dress goods or cloakings, much larger effects are often produced, it being not at all unusual to find checks two inches or more in diameter.

The cloakings are made usually from coarse wools, finished with considerable nap, and invariably made from yarns of relatively coarse numbers. The fabric selected for analysis is a medium-weight worsted men's wear, such as is used in quantity by the large manufacturing clothiers. Instead of using a straight draw, as is the usual custom, every fourth set of dark



Gun Club Check.

threads are drawn on alternate harnesses, giving the effect of a stripe at intervals of approximately an inch. The yarns used in the manufacture of the fabric under discussion were made from well-grown three-eighths territory wool, carefully sorted and well scoured. In the latter operation, it is necessary to use great care if the best possible fabric is to be made from the stock used. The statement is often made that it

Requires Much Less Skill

to produce a sightly and salable fabric from worsted and other high-grade stocks than from the cheaper wools and substitutes. There is much truth in this remark, but it is equally as true that skill and care are necessary to produce the highest possible type of merchandise from the more expensive raw materials, and it is also a fact that lack of care in some of the apparently unimportant processes will very much depreciate the quality of the finished product.

This fact is seemingly overlooked at times by those in charge of the various departments, and results in considerable worry and anxiety on the part of the finisher and dyer when the finished goods are not up to the standard. To many of those who are conversant with the manufacture of worsted cloths the preparatory processes from raw stock to spun yarn are a sealed book. They have a more or less hazy idea that worsted yarn is prepared from wool by means of special machinery, and most of them are aware that somewhere in the system there is a combing process, but have no definite idea as to what the comb is nor the functions it has in the system of manufacture. There are many engaged in the various operations of worsted cloth making who have

Never Seen the Wool

in its natural condition, and have but a faint idea of the various processes necessary to convert it into the strong, smooth thread they are accustomed

to handle. It is generally considered that the manufacture of worsted yarns is an entirely separate branch of the industry, and for that reason comparatively few are conversant with both yarn production and weaving.

The weaver forms his opinion of the yarn from the appearance, handle and breaking strength of the sample, and is totally unable to determine the cause for one lot being distinctly inferior to another of the same grade. To one thoroughly familiar with the manufacture of yarn from the raw stock, the cause of the inferiority may be readily located, and in many instances may be traced to lack of due care in one of the

So-Called Unimportant Processes.

If the best possible results are to be obtained, it must be impressed on the minds of every operative and overseer that there is absolutely no such thing as an "unimportant process" in textile manufacturing. Each individual process is extremely important and should receive as much care as though the success of the whole mill depended on its proper performance. Wool scouring, in itself a seemingly simple operation, may be so poorly done as to reduce the value of the scoured wool to an amazing degree, and to this, the first mechanical process in the manufacture of yarns, may be traced much of the trouble that develops in other departments. It may be thought that such a statement is overdrawn, but many years' experience has taught us that the scouring is one of the

Most Prolific Sources of Trouble

that exists in the mill. This is because of the peculiar physical structure of the wool fibre itself and its susceptibility to injuries of various kinds that materially impair its strength and working qualities. To preserve the life, elasticity and luster of the wool and bring it out clean, white and lofty should be the aim of those in charge of this very important process.

In order to obtain these results, it is essential that the water supply should be suitable for the purpose, that is, free from hardness, as it is impossible to satisfactorily cleanse wool in hard water. The detergents must be of good quality, free from impurities of any kind that shall affect the wool adversely, and the temperature of the scouring bath must not be too high. Under such conditions, and these only, is it possible to secure results that are satisfactory.

In preparing wool for worsted manufacture there is much less danger of injuring the stock by excessive heat in drying, as in the majority of cases it is not thoroughly dried but taken to the cards in a slightly moist condition, and not entirely free from soap. This is done as an

Aid to the Carding Process,

as the wool while moist is more easily opened and carded, with much less probability of injury to the staple. In every process—preparing, combing, gilling and drawing—the utmost care should be observed to preserve the uniformity of the sliver, and the drafts must be arranged with due consideration for the length of the fibre in process. It must not be supposed that all so-called 60s, 56s or 46s tops can be treated alike, as they will vary considerably in length, and must be processed accordingly. The numbers given tops are quality numbers, and are not supposed to be the equivalents of the yarn sizes to which the tops may be spun, as many suppose.

The roving and reducing frames should be examined two or three times daily to see that there are no defective top rolls, as worn rolls will result in slubby, uneven yarn, and make a very appreciable increase in the cost of burling and sewing, as well as decreasing the production in the weave room.

Finishing Expense Increased.

The spun yarn must be doubled and twisted before it is in condition for use, and in these operations there is much room for improvement. In

many mills the spinner bobbins are put up on the trap twister, the intermediate operation of doubling being dispensed with. While apparently decreasing manufacturing expense, this method is considered by many of our more progressive manufacturers to be false economy. The saving effected is more apparent than real, as the use of a cone winder and a doubling machine, while involving an immediate expense for installation and a constant labor charge, will more than offset these items by the greatly increased production from the twisters and the vastly superior quality of the yarn.

Efficiency and Labor Cost.

True efficiency does not consist in all cases of reducing the expense of the particular process under consideration, but is obtained in some cases by increasing the cost of one operation, thus obtaining a more perfect product that in subsequent processes will permit of the elimination of much labor and waste, showing a saving much greater than the former expense, and above all, making possible the production of a more nearly perfect fabric.

Yarn inspection is of vital importance in the economics of mill management, and has been the subject of no little discussion as to the method calculated to secure the best results. In many spinning plants, yarns which are to be dyed are reeled directly from the spinning bobbins and inspected in the skein. This method, while having some good points, has more defects. It is difficult for the operative to find and remove all the imperfections, and results, in the majority of instances, in more or less entangling of the skein, so that winding is made more difficult, with an increased amount of waste. A much bettter method is that in use in a Rhode Island mill, where every pound of yarn made, whether to be shipped in skeins or on jack spools, is placed on the inspecting spooler.

Inspecting Spoolers.

This differs but little from the ordinary worsted spooler, except that there is increased space between the back and front guides, and in this space is placed a board painted black, over which the threads pass at a slow speed, enabling the operative, seated behind the spool, to readily see and remove the various imperfections. A new type of inspecting spooler, especially adapted for ease of inspection and high relative production is the multiple inspection spooler, perfected by the late David D. McTaggart, and manufactured by the Warp Compressing Machine Company, Worcester, Mass. In this machine is combined perfection of spooling and ease of inspection. In a suitable rack the six-inch spools or other packages of yarn are placed to the number of 240. The ends are laid over a fixed roll, under a roll movable in a vertical plane, which operates to take up the slack caused by the overrun of the spools, over another fixed bearing roll, down in front of a black screen which makes easily discernible the imperfections, and across to the front of the spooler, in front of which the operative is seated, thence to the compressing spooler rolls. The machine is capable of a high percentage of production, is fitted with electrical stop motion, and the spooling is the most perfect yet seen, each spool running off clean to the barrel with no overrun, slack ends or crossed threads.

For the fabric we are to make the yarns are taken to the reels and put into two-ounce skeins for the dyehouse. The

Method of Skein Dyeing

now most generally used is that in which the skeins are placed on sticks in a machine of the Ferris wheel type, kept extended to nearly their full length during operation, and by the rotation of the spiders alternately submerged in the dye-bath and raised from it. The dyes should be dissolved

in a tub or pail and strained before being fed into the dye-kettle, or uneven and streaky yarns may result. Do not raise to a boil too rapidly, and when the bath has boiled for about twenty minutes take a sample to see that the work is progressing satisfactorily. When the desired shade has been obtained, draw off the kettle, extract and hang the skeins on poles to dry, or still better, place them on a cold air drying machine, which will insure much more satisfactory results. Dry thoroughly and take to the winders for transference to six-inch spools, from which the yarns may be readily placed on jack spools for the dresser or winder. Dressing and weaving should be easily accomplished, as the yarns are strong and elastic. When woven, inspected and measured, the burlers must raise the knots on both sides, remove slugs and bits of foreign matter, tangled ends of broken threads, etc., before sending the pieces to the sewers. The sewers must replace broken ends and picks, repair wrong draws, hard twist and other imperfections, putting the pieces in as nearly perfect condition as possible, when they are ready for scouring.

For Scouring Worsteds

a pure palm oil soap will be found to give excellent results, and will not require any great reenforcement with alkali, as the grease content of the fabric is small. Scour until satisfied that the goods are clean, then rinse until every trace of soap is removed, extract and dry at a moderate heat. Give a run on the polisher and shear close enough to bring every thread up round and distinct. After shearing they should be inspected and, if necessary, taken to the fine sewers, who will repair any defects. Brush, spray and press, allowing them to cool off in the roll.

LAYOUT.

3,360 ends; 13 reed, 4 per dent = 64.6" + 1½" for listing = 66" over all.

56 picks.

Dressed:

Light slate 2/32 worsted.	2	4	2	8
Dark slate 2/32 worsted.	4			4
Black 2/32 worsted.....		4		4
				16
				30
				480
				*7
				3,360

*Sections.

Filling:

Light slate 2/32 worsted.	4	4		8
Dark slate 2/32 worsted.	4			4
Black 2/32 worsted.....		4		4
				16

CALCULATIONS.

3,360 ends 2/32 = 6 oz. + 10% take-up ..... = 6.66 oz.

$$56 \text{ picks } 2/32 = \frac{56 \times 66}{560 \times 32 \div 16 \div 2} = 6.60 \text{ oz.}$$

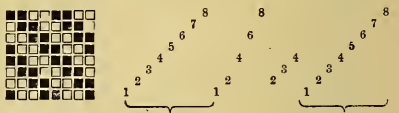
Loom weight ..... 13.26 oz.

13.26 oz. worsted + 10% waste = 14.06 oz.

COST.

2/32 worsted @ 76c. per lb.
14.06 oz. @ 4¾c. (stock cost)..... = $ .6678
Manufacturing, 56 picks..... = .3580

Net mill cost..... $1.0258

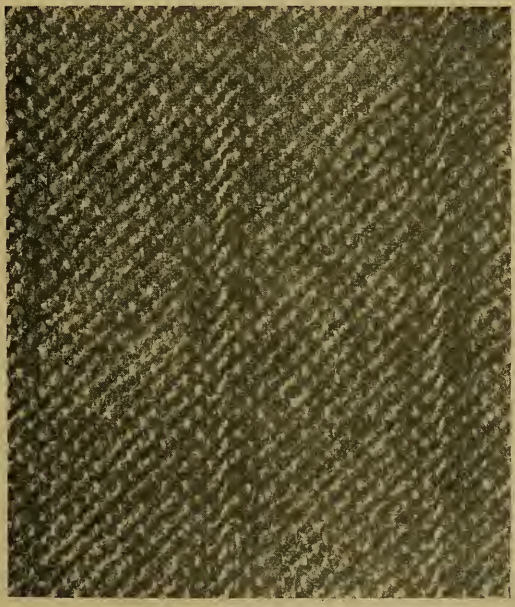


SCOTCH TWEEDS

We gather from history that Egypt, the cradle of so many of our handicrafts, was the birthplace of the loom and the art of weaving; France to have given us the jacquard loom, the most capable mechanism for producing ornamental woven fabrics; Germany to have increased the multiplicity of colors and shades employed in the textile trade; England to have given us the most improved machinery for transforming the raw material into yarns and cloths, and Scotland may boast of being the country which gave

to the world the Scotch tweed—the pure unadulterated tweed, with its soft, cosy handle, its strength and its elasticity, its rich and tasteful colorings, which vie with nature herself in the harmonious blending of colors. Surely none but a Scotchman, steeped in the colorings of the heather hills, could devise such rich mixtures of colors, mingling them in such harmonious proportions that each blend or mixture represents in itself a little touch of "Auld Scotland" so dear to the hearts of her sons and daughters.

The writer was much interested in reading in this paper, during April, articles on the "Introduction and Development of the Scotch Tweeds." The author of these articles stated the origin of the heather mixtures, which were actually copied from the blendings of the heather bloom, brackens and grasses on Buckholm Hill at Galashiels. The author also mentioned copying the blends of colors in the rocks, the reds, blues and greens mixing with the slates and neutral greys of the lichens. There are the well-known Lovat mixtures, originated by Sir John Lovat, and which represent the colorings



Scotch Tweed.

of a Scottish moor at the beginning of the shooting season, which opens on August 12. There are also the mixtures of browns, reds and gold, which remind one of the same moors during the autumn months, when nature runs riot with colors, and which can be seen by anyone in our own New England White Mountains, when the leaves are turning and painting the landscape in a mass of color so rich in its harmonies and so effective in its contrasts that the lovers of nature stand transfixed with the beauty of the picture that Dame Nature has painted for them.

Most Popular Shades had Homely Origins.

While it is true that the manufacturers and designers of the Scotch

tweeds have received much inspiration from the colorings of the rugged hills and barren rocks, the writer recalls the origin of a very fashionable shade gotten up by a Hawick manufacturer many years ago, who was passing along one morning by the side of the mill raceway, and noted the discharge of water from the scouring rooms and dyehouse. He called to a boy, "Say, laddie, rin and tell Tam (the dyer) to cam here." Tam came, wondering what the boss wanted with him on the bank of the raceway. Possibly the thought that he had discovered too much dyestuff going down the river, but the smile on his face and his eager look belied such a suspicion. "Tam, man! d'ye see that water? (meaning the soapy mixture from scouring and dye room). I want you to dye me that shade." Tam dyed it, and the shade was the rage in London that season, and it is safe to say that the manufacturer did not tell of the homely origin of his "scoop" in the color world.

The popularity of Scotch tweeds depends upon three things: The sterling value and soundness of the yarns employed, the artistic and model effects of the arrangement of the colors, and lastly, great care that the dyes used should not be of a fugitive nature. The weaves used generally are the plain cloth and the four-harness twill, probably 15 out of every 20 pieces being made up of one or the other of these weaves, the four-harness twill giving the best handle of cloth, and standing the tear and wear most satisfactorily in Saxony and cheviot goods.

In the originating and blending of colors in new mixtures great care should be given to color harmony and the proportions of each color in regard to its complementary color. For instance, note how a bright green leaf or a brilliant emerald at the throat intensifies the freshness of the ladies' complexion; the ripe red cherries among the glossy green leaves, or the yellow pansy with its purple throat, are examples of the happy color combinations in art and nature. In order to get an idea of

Color Harmonies,

mark out an equal-sided triangle on a piece of paper. On one side or angle write red, another blue, another yellow. These are the primary colors, and all others are made by combinations of these three. Between the blue and red write purple; between blue and yellow write green, and between red and yellow write orange. These are made by the union of the two nearest colors. The opposite colors of the triangle are complementary to each other. Red is complementary of green, yellow of purple, blue of orange, and so on through the numberless grades of these colors. Now, in order to give the greatest value to any color, its complement of the same strength should accompany it. But if a color is to be subdued, put a nearly related color with it instead of its complement. For instance to subdue a too yellow face use yellow trimmings or gold ornaments but never purple, which is the complementary color of yellow and intensifies that shade.

Neutral tints of different shades in combination are all right except that they look rather flat and are not especially attractive but when a high color is used in a mixture its complement of similar strength or some color nearly related to its complement should go with it. Different shades of the same color kill each other every time. Red and purple, red and orange, blue and green, blue and purple, yellow and orange or yellow and green should never go together except to subdue each other. They are first cousins and should never wed. If anyone desires to

Experiment for Himself

and find the complementary color of any other shade, let him look intently for a minute in a strong light at a round spot of any fancy color, then gaze at a piece of white paper and he will see its complementary color reflected on the paper. In selecting wools for mixtures always choose a free, open

wool for the white and the bright, fancy colors. This wool should be somewhat finer than that which is used for the dark colors. The reason for this is that when you use a coarse wool for white and the bright, fancy shades, it gives a coarse, hairy appearance to the goods and detracts from the appearance of the cloth. Coarser wools may be used in all the dark shades. The following are a few of them:

38%	Med. blue indigo.
38%	Claret.
12%	Yellow.
12%	White.
100%	

50%	White.
38%	Cinnamon brown.
12%	Fawn drab.
100%	

67%	Black.
25%	Dark plum.
8%	Scarlet.
100%	

25%	Orange.
5%	Bright red.
20%	White.
20%	Green, pine tree.
30%	Tan, light shade oak leaf after frost.
100%	

15%	Heather bloom.
10%	Old gold.
20%	White.
55%	Olive. (greenish shade).
100%	

20%	Cinnamon brown.
12½%	Dark purple.
10%	Old gold.
57½%	White.
100%	

15%	Purple.
10%	Old gold.
10%	Apple green.
65%	White.
100%	

40%	Med. indigo blue.
30%	Bismark brown.
30%	Yellow.
100%	

45%	White.
35%	Green.
15%	Orange.
5%	Red.
100%	

38%	Med. indigo blue.
22%	White.
12%	Dark yellow brown.
12%	Purple.
16%	Bright yellow.
100%	

17½%	Canary.
7½%	Bright blue.
15%	Pine tree green.
15%	Heather bloom.
45%	Black.
100%	

10%	Orange.
25%	Dark stone drab.
30%	Heather bloom.
35%	Light tan.
100%	

15%	Old gold.
10%	Purple.
15%	Apple green.
60%	Med. navy blue.
100%	

20%	Golden yellow.
45%	White.
35%	Black.
100%	

In the successful manufacture of these Scotch woolens, whether in the fine Saxonies or in the cheviot mixtures, there are a great many points throughout each department of the mill which play an important part in the appearance of the finished goods. These points, separately, may seem to a person who is not trained in the business as trifling and unimportant, but collectively they are of great moment, as each particular part contributes its share in producing a perfect piece of goods. It is by having a thorough knowledge of all these general points that the products of some manufacturers excel so much in the general appearance and handle others who may be using the same stock, and, to all intents and purposes, making the same class of goods; yet there is a great difference in the finished product, so much so that an experienced buyer can lay his hand on the best and say, "This is the handle and finish I want." This

Knowledge of "Small Things"

can only be acquired by careful attention and close observation through many years of practical manufacturing in progressive mills. A successful

manufacturer must have a thorough knowledge of wools, not only as to grade and quality but should understand the peculiarities and nature of the different grades, and how each will card, spin and finish. It is also essential to have a good general knowledge of the processes of finishing the various fabrics, in order to be able to select and blend the most suitable wools for any particular fabric and finish. It is well known to all practical men that wools which are suitable for one fabric and finish may be quite inappropriate for another one. For fine mixtures and twists the wools should be very carefully selected, as imperfect and faulty wools will cause specks in the mixtures and uneven or twitty yarns; but such wools may be used in solid or dark colors if the yarns are not to be spun very fine. All lots of wool should be graded or sorted into the different lots in order to get the percentage of each grade, and tests should be made of each to find the loss in scouring, so that a manufacturer may know the cost of the clean wool of each lot.

Clean and Lofty Wools Important.

It is important to have the wools clean and lofty, not only on account of the dyeing but for the after processes of carding and spinning, as clean wool will dye into more brilliant colors, card more freely, spin to finer counts and finish up with a better luster. Wools badly scoured will not take the dye evenly, and the colors will be dull and lifeless. In carding, the machines will "gum up," the roping will be uneven and twitty, and there will be a large percentage of waste. Wools well scoured and prepared make easy work in the card room and good results in all the after processes.

By far the best results in wool scouring are obtained by the use of potash salts, in fact, no other alkali should be used in wool scouring. This is fully borne out by nature, which invariably assimilates the most appropriate substances. The natural grease of the wool consists of nearly half its weight of carbonate of potash, hardly a trace of soda being present. The difference between the use of potash and soda for this purpose is very marked. Potash softens the wool, making it handle lofty, and also to a certain extent bleaches or whitens it, while soda has a tendency to make the fibres harsh and gives it a dull appearance.

Let us now pass the carding and spinning of the yarns and turn our attention to the

Design Department

and its relation to the success of the mill. In order to produce novelty in design, a large amount of painstaking work must be bestowed in the effort. We have too few designers who can really devote a proper length of time to the work, and too few manufacturers who supply the needed stimulus in the shape of good textile journals and selected patterns from other centers of trade. These samples are not for copying, but they give a stimulus in ideas for color combinations and in fabrication of cloths. There has not been much in woven design of late years in Scotch tweeds. The weave used has been principally the four-harness twill, and the design has been made by the combination of colors and mixtures, enhanced by the skillful use of fancy threads for stripe effects, these fancy threads in many cases being fine silk yarns, and it is here that skillful arrangement of pattern and colors shows to advantage. Harmonious colorings are always wanted, and it may be truly said that the first thing the merchant or consumer looks at is the color, or the harmony of color, employed in the design, and unless this is pleasing to the eye, the fabric however well made will find but an indifferent market. Strictly speaking, the buyer purchases the cloth on the merits of the colors, the quality, of course, being right, rather than on the merits of the weave or the pattern design.

The Scotch tweed is made both in the fine Saxony wools and in the coarser crossbreds and cheviots, but it is more in the cheviot qualities that we find the characteristic Scottish mixtures, the coarser lustrous wools showing up the rich combination of colors to greater advantage, and in some way the quality of the wools harmonize with the general character of both color and fabric. But if the same strong colors were used in the mixtures of fine Saxony woolens, the effect would be incongruous, and lacking in harmony and adaptability. In the fine Saxony tweed the colors are more subdued and softer. The designs are neat and unobtrusive, but there is a certain character in the Saxony cloth that is distinctive, and it does not need strong or loud mixtures to make it so, but rather the reverse. Scotch manufacturers are continually experimenting in new combinations of wools to get new effects, and a fine mohair wool may be used in varying proportions, also Llama wools, etc.

Finishing.

The finishing of Scotch tweeds is a very important part, and requires careful attention, as the handle and appearance of the finished product is as essential as the color or design, and an unsatisfactory finish would condemn a cloth however good it may be in all other respects. The usual process is to scour the goods before fulling, as this gives a more lofty handle to the fabric and brighter colors. A light scouring liquor is best for this purpose, say about 1½ to 2 ounces of soap to the gallon, and this may be strengthened by adding a few pailfuls of a liquor made up with ammoniated potash, which will assure a thorough saponification of all oils, etc., in the goods, and allow of its being readily rinsed off. The fulling soap should be almost neutral and made up of pure materials. The goods while in the process of fulling should be kept cool, very little fulling being needed, as the characteristic of the cloth is loftiness and softness of handle, and any excess of fulling would render it stiff and boardy.

In the final scouring, after fulling, use plenty of warm water, not over 110 degrees, rinsing well, and give a few pints of aqua ammonia in the last scouring bath, which will insure the thorough saponification of all fatty acids and guarantee bright, snappy colors in the goods. After the soap is all rinsed out of the goods,

Give a Bath of Fuller's Earth,

which has wonderful softening and cleansing properties that are much appreciated by all Scottish finishers. The usual proportion is two pailfuls of the refined earth to a barrel of water, and use six pailfuls of this solution in a four-string washer. Run for 15 to 20 minutes, and rinse well in cold water. This treatment will give a very soft and kindly handle to the goods. After extracting the goods, roll them up under heavy pressure on a roll, and let them lie overnight. Dry next day at as low a temperature as is consistent with the production of the mill, and before shearing give the pieces a good brushing on a steam brush. Do not shear close, cut off any rough fibres, but leave all the fine, short nap. Give a good run on the dewing machine, and let it lie some hours before pressing. Press medium, and let goods lie on roll until cold.

SCOTCH SAXONY TWEED. LAYOUT.

1,920 ends; reed 9¼ $\frac{6}{3}\ \frac{1}{4}\ \frac{6}{3}$ = 66" inside listing + 1" for listing = 67" over all.

Warp pattern:

		Thrds.
Twist	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	=15
White	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	=18
Grey	1 1 1 1	= 4
Silk	3	= 3

40 threads in pattern × 8 patterns × 6 sections = 1,920 ends.

YARNS.

Twist .....5 x 5 runs, left twist; 50% grey and white, twist right (12 turns).
White.....2¼ runs, right twist.
Grey .....2¼ runs, right twist, 50% white mix.
Silk .....20/2s white.
Filling: Black 2¾ run, spun soft, right twist, crossbred wool.

720 ends 5 x 5 run twist	= 2¼ runs	=	3.20 oz.
864 ends white	= 2¼ runs	=	3.84 oz.
192 ends grey, 50%	= 2¼ runs	=	0.85 oz.
144 ends white silk	= 20/2s	=	0.27 oz.
Filling, 67" × 36 picks = 2,412 ÷ 2¾ run		=	8.77 oz.
			16.93 oz.
Plus 10%		=	1.69 oz.
Loom weight			18.62 oz.

Finished weight, 15 oz.

7.89 oz. warp yarn, fine wool + 10% + 15% waste allowance	=	10.20 oz.
27 oz. warp silk + 10% + 3% waste allowance	=	.31 oz.
8.77 oz. filling crossbred + 10% + 15% waste allowance	=	11.34 oz.

COST.

10.20 oz. fine wool @ 56 cents per pound	=	$ .3570
.27 oz. silk @ $3 per pound	=	.0506
8.77 oz. crossbred @ 44 cents per pound	=	.2411
		$ .6487
Manufacturing charges: 36 picks @ 94/100	=	.3384
Extra for twisting	=	.0124
Net cost		$ .9995

NOVELTY CHEVIOT DRESS GOODS

The demand for novelties in fabrics for ladies' wear has led to the use of a great variety of unusual and freak yarns in the offerings for the present season. A large proportion of these require the use of special machinery in their manufacture and are rendered expensive from the fact that they are produced slowly and entail a large number of operations in their preparation. In the case of the ratiné and eponge yarns this is particularly noticeable, as the loop, or knot, must be made on a special twister and a binder thread afterward put on by means of another operation. It will be readily understood that each process in the production of a yarn or fabric adds materially to the cost of manufacture and must be figured in the price of the goods. A large number of the dress goods into which novelty yarns are woven

Have Been Woven in the Grey

and colored into solid shades, the only unusual feature being the peculiar type of yarn from which they are constructed. The fabric chosen for analysis here is made from relatively coarse yarns in two-ply of contrasting colors. From examination of the finished sample it is impossible to determine whether the shades were both made by top-dyeing, or the black was top-dyed, twisted with a white, and the fancy color is the result of piece-dyeing. The texture of the fabric is somewhat low, counting only 38 threads per inch in the warp, with an equal number in the filling. Instead of em-

ploying a somewhat tighter weave, as is customary in most instances with a cloth of comparatively low texture, the direct opposite is the case, and the six-harness even-sided twill has been used. The result is a rather loosely woven cloth, but one that should prove very satisfactory for the uses for which it is intended.

There are many reasons to suppose the goods are woven black and white, with the white colored in the piece. The advantages to be derived from this method are many and will be readily appreciated by anyone conversant with manufacturing processes. By this method a larger part of the waste made will be in an uncolored condition, thereby commanding a higher price and a much more ready sale. A still more important consideration is the fact that a great variety of styles can be made from the same warps, a fact that means many times the difference between a successful season and one that proves unprofitable. By weaving the goods black and white, it is possible to put larger quantities of yarn in the warps, which means a

Saving of Expense in the Spinning

mill, and this method also permits of better deliveries to customers of desirable colors. If the goods are made from slub-dyed yarns, it is necessary to put in process warps of each shade sold, but by the piece-dyeing method it is only necessary to weave the black and white, get them ready for the dyehouse, and color the desired shades as they are needed to fill orders.

The yarns are spun on the Bradford system from crossbred wools of good staple, but not particularly high grade. For the goods here described a quarter-blood wool was used, probably a South American. After sorting and scouring, the stock was carded, put through the slubbing gill boxes and placed on a Noble comb. After combing, the top from which the black was to be made was put through a gill box and wound into balls ready for the dyehouse. In some mills it is still the custom to color tops in a machine primarily intended for yarn in the skein, but the great amount of waste made and the unsatisfactory results achieved have led to the installation of more modern methods in the majority of plants. One of the most satisfactory appliances for coloring worsted tops is an arrangement essentially as described. The balls are packed in a suitable receptacle around a central perforated spindle, and the whole submerged in a tank containing the dye-liquor. A pump is piped to the central spindle and forces the hot dye-bath through the stock, securing perfect penetration and

Absolutely Level Dyeing,

with no injury to the tops, which is more than can be truthfully said of some of the processes in use. When the desired shade has been obtained, the dye-bath is drawn off, the tops cooled and rinsed in cold water. After extracting, the balls of top are sent to the back washer, where they are thoroughly cleansed and dried. From the back washer they proceed through the necessary gilling process, then into the drawing room, where, by successive doublings and drawings, the fibre is finally made into a roving of the size required to spin the yarn necessary for the goods to be made.

Meantime the white stock has passed through a series of similar operations, aside from the dyeing, and has been spun into yarn ready for the doubling. In some plants it is customary to double and twist in two operations, while in others the trap twister is used, which permits of performing both operations on the same machine at one time, a considerable saving in labor and expense. In making the two-ply the twist should not exceed eight turns per inch. When twisted the yarn should be wound on six-inch spools, from which it is transferred to the dresser spool by

Means of the Inspecting Spooler.

This differs somewhat from the ordinary type of spooler in that it is operated at a much lower rate of speed and has between the front and back

guides a space of some 20 to 30 inches. In this space is arranged a board which is painted to contrast with the yarns to be inspected. Over this the yarn travels at a speed which enables the operator to detect imperfections and remove them, saving much valuable time in the finishing room, as it will be easily understood that imperfect yarn may be removed here much more readily than from the woven cloth, and at a materially lower cost. The warps are made on a dry dressing frame and transferred directly to the loom beam, as there is no danger of chafing and breaking during the process of weaving. The use of a

Warp Compressor

while beaming is a distinct advantage, as it allows of dressing and beaming without undue strain on the yarn and permits of placing a considerably greater yardage on the beam than is possible without an appliance of this nature. Not only is it a saving in thrums and head ends because of the greater length of warp possible to place on a beam, but the warp is appreciably firmer, weaves better, and has the natural life and elasticity of the yarn preserved to a marked degree, making a distinctly better piece of goods than can be produced without its use.

Fabrics of this type are particularly well adapted for weaving on the two-loom system, as the yarns are strong, have no tendency to chafe and should run with a minimum of breakage from beginning to end of the warp. If the loom is well adjusted when the warp is started there should be practically no occasion for the fixer to touch it for days at a time, aside from the necessity of replacing a broken strap or a part that becomes worn. A very important feature that is overlooked by some weavers is the

Proper Oiling of the Loom.

Unless this extremely important detail receives attention at proper intervals it is impossible to get the production that should be had from the weave room. In not a few cases it has been found that the chief reason for the unsatisfactory wage earned by a weaver is the lack of care given the loom and inattention to the proper oiling of the parts. It is impossible for any piece of machinery to do satisfactory work if it is allowed to become clogged with dirt or stiff from lack of proper lubrication. It is not by any means an unknown occurrence for weavers to so mistreat a loom that it

Becomes Fit for the Scrap Heap,

while another, bought at the same time and used under practically the same conditions, remains, to all intents and purposes, as good as new, simply owing to the fact that one has been operated by an intelligent weaver, while the other has been abused by an inferior type of operative.

Under good average conditions it should be possible to attain an extremely good production at a low cost for supplies and overhead expense, as the looms, preferably 82-inch, may be operated at a speed of 110 picks a minute, and should give no trouble at that speed if well cared for. In fact, it is common practice to operate 82-inch looms at 120 picks per minute on much more difficult fabrics than the type here analyzed. It must not be understood from the foregoing that excessive speed is advocated, as it is an incontrovertible fact that

High Speed and Production

are not in a direct ratio. There are many instances that can be cited to prove that a reduction of speed has increased the production. There is a point where an increase of speed ceases to mean an increase of output, and the skilled overseer will be guided by conditions in his department, in deciding as to when the limit has been reached. It would be the height of folly to put forward the claim that the looms should be operated at a certain speed under every condition. That high speed with strong two-ply warps and comparatively easy weaves is feasible cannot be successfully disputed,

but that the same speed should be used with single or tender warps of fine yarns is not to be thought of, and if one has so little good judgment as to undertake it, failure will be the inevitable result of such a trial. As soon as convenient, after coming from the looms, the pieces should be measured, inspected, the imperfections marked and the necessary memoranda made in a book or on sheets provided for the purpose, so that such detailed information concerning each piece may be readily available should it become desirable to look it up at any time. The burling and mending should require but little time, as the goods should be comparatively free from knots, slugs or broken threads.

From the sewing room the pieces are taken to the washer and thoroughly scoured, then put through the crabbing machine and are

Ready for the Dyehouse.

There should be no difficulty in bringing the goods out even in color and free from shades if the preliminary operations have been carefully performed. One of the most common sources of uneven results in the dyehouse is the crabbing operation, and this should have careful supervision. On the completion of the coloring, the pieces should be cooled off and rinsed before they are removed from the dye-kettle, then immediately extracted and dried. The drying is usually accomplished by means of a chain dryer, which carries the damp cloth into a drying chamber, where the air is heated by means of steam pipes. Care should be observed not to dry the goods too rapidly, as the handle of the goods is deteriorated by excessive heat. A single run over the shear is all that will be necessary, then the pieces may be brushed, sprayed and pressed.

LAYOUT.

2,044 ends; 7¾ reed, 4 in dent = 64" + 1½" for listing = 65.5" over all.
38 picks.

CALCULATIONS.

2,044 ends 2/24 worsted = 4.866 oz.
+ 5% take-up .....= 5.12 oz.

$$38 \text{ picks } 2/24 = \frac{38 \times 65.5}{24 \times 560 \div 2 \div 16} = 5.92 \text{ oz.}$$

Loom weight ..... 11.04 oz.

COST.

11.04 oz. + 7% waste = 11.87 oz.
@ 76c. per lb. .....= $ .5638
Manufacturing, 38 picks .....= .2300

Net mill cost ..... $ .7938

6 harness, straight draw.

WORSTED SHEPHERD PLAID

Domestic manufacturers of dress goods are not given the credit they deserve in many instances. In selling piece goods over the counter, or ready-to-wear gowns, many of the sales force are tempted to insinuate, if not to state boldly, that the fabrics are the product of foreign manufacturers, when, if the truth was known, the cloth or gown in question is entirely a domestic production, made from wools grown in our own country, the yarns manufactured by a domestic spinner and the goods woven in one of our New England mills. Fortunately, the word "foreign" is not of as great weight with the consumer as formerly, experience having taught many buyers that domestic cloths are as satisfactory and, in many cases, of more intrinsic worth than those from abroad. The many buyers who have been told so often by the high-priced department stores that "these models are all made from imported fabrics" and "it is impossible to obtain the beautiful lines of this gown if we use domestic cloths" should take these stories with a liberal allowance of salt. In the great majority of cases the fabrics are the production of domestic manufacturers, and the model was designed in a "studio" on Manhattan Island. The fabric shown

herewith is made from a fine territory staple wool, spun to comparatively high counts, giving a fine texture with relatively light weight. The use of a fine wool not only permits of producing a fine, light-weight cloth, but also gives a fabric that lends itself readily to the draped effects that are now so popular a feature of garments for women's wear. In addition to this very essential feature, it also possesses a particularly soft, silky handle that can be obtained only by the use of a fine, well-grown, healthy wool.

There are many reasons why fabrics of this type are more particularly adapted for production in combed than in carded yarns, especially if they are to be used in women's apparel. One of the most important is the fact that a much lighter-weight cloth may be made, and another is that on the worsted system it is possible to produce a thread that is much finer than any that can possibly be manufactured without the aid of combs, and by using these fine yarns it is a comparatively easy matter to produce

A Cloth of High Texture,

which enhances the appearance of the fabric very materially. Then, too, the inherent differences in the yarns, made by these two totally dissimilar methods of production, have a very decided effect upon the ultimate appearance of the finished goods. To one familiar with the procedure in making worsted and woolen yarns this statement will need nothing in the way of confirmation or explanation, but for the enlightenment of those who have never had the pleasure and privilege of seeing the manufacturing processes of both systems, a short explanation of each may be of interest.

In the production of carded, or as they are generally termed "woolen" yarns, the operations are few and comparatively simple. The wool is given a certain amount of oil, varying with the grade and amount of other stocks used in combination, run through the mixing picker, which thoroughly opens and mixes the stock, leaving it in first-class condition for the cards.

Carding Most Important.

This is possibly the most important department in a woolen mill, although some of our friends who are dyers and finishers may take exception to such a statement. Nevertheless, the extreme importance of good work in the card room will be admitted by everyone, as it may be stated with no fear of successful contradiction, that careless work in this department means greater expense, less production and inferior results in every succeeding process. The primary object of carding is to complete the mixing and opening of the wool which was begun in the mixing picker, making an even and homogeneous blend of the various colors and stocks, and to reduce the mass of stock to ribbons of suitable size for spinning into thread. The fundamental difference between a woolen and worsted thread is that in the latter there is but little effort toward the parallelization of the fibres, while the whole tendency and aim of the worsted system is to produce a thread, every fibre of which shall be

Laid Straight and Parallel

to each other. In the woolen system, it is the custom to use three cards in a set, termed the first breaker, second breaker and finisher. The three machines are very similar, and each does its part in practically the same manner as each of the others, the principal difference being in the manner of feeding and delivery. The first breaker is fed by a mechanism that automatically weighs and delivers to the feed apron the amount of wool required to make the desired size of yarn, and as this is carried into the card by the traveling feed apron, another portion of stock is weighed and deposited directly behind the former, so that a continuous feed of even weight is delivered to the feed rolls. The card consists essentially of a main cylinder, usually 48 inches in diameter and of the same width, covered with leather

or cloth, thickly studded with fine wire similar to the teeth of a comb, which engage the stock and carry it forward. At intervals there are set smaller rolls, termed workers, also covered with wire clothing, the teeth of which also engage the stock and tend to comb it out, laying the fibres nearly parallel. These are, in turn, cleared of the stock by the

Smaller Strippers,

which return it to the cylinder, which carries it to the next worker, where a similar process takes place. The number of workers varies with the size of the card, but is seldom less than five. Behind the last worker a short space intervenes, and the stock comes in contact with the "fancy." This does no carding, but is designed to raise the stock so that it may be removed from the main cylinder by the doffer, from which it is taken in a flat web by the comb and carried away in rope form by the side drawing apparatus.

The side drawing is fed to the second breaker, where the same processes of carding are repeated, and the stock discharged in the same manner and delivered to the finisher card. This is similar to the first and second breakers, except at the delivery end, where instead of one doffer completely covered with wire there are two smaller doffers which have alternately a circle of wire and an empty space, the wire of the upper doffer being opposite the blank space of the lower. From these the stock is removed by small rolls covered with corduroy, and the ribbons of stock delivered

To the Condenser,

where they receive a rubbing between aprons which have a sidewise reciprocating motion as well as a constant forward travel. The "roving," as it is now called, is wound on spools by a suitable mechanism, and is ready for the spinning process, which is invariably performed on mules. It will be readily seen that the partial parallelization of the stock during its progress through the cards is in a large measure overcome by the effect of removing it in the form of a side drawing, a motion at right angles to its direction of travel through the machine itself. On the other hand, the manufacture of worsted yarn is carried on by a system of machinery that at all times retains the fibres in the same relative position. The carding is performed on a double cylinder card, and the web removed through a stationary trumpet in the direction of motion through the card and wound in a ball. These balls of slubbing are placed in a preparing gill box which further straightens the fibres by drawing them through a set of fallers, provided with pins which have a combing action on the slubbing. From the gill box it goes to the machine, which rolls four ends of slubbing in a ball ready for the comb. The usual type of combs used in domestic mills is the

"Noble" or "Great Circle" Comb.

The essential features are suitable carriers for the balls of slubbing and a feeding motion which delivers the slubbing to the circle. The great circle is set with pins, as are also two smaller circles, set diametrically opposite each other, the circumferences of which are nearly in contact with the inner circumference of the large circle. The slubbing is forced into the pins of both circles, and as they revolve at even surface speeds, the long fibres of wool are drawn out and removed by a set of aprons in a continuous ribbon of "top." The short fibres, burs and other foreign matter are raised from the pins of the circles and fall to the floor. In each succeeding process the operation is one of reducing the size of the sliver by drawing it in in a straight line, each succeeding machine drawing in the opposite direction from that immediately preceding, thus tending to make a uniform sliver. By means of successive doublings and drawings the sliver is reduced to a suitable size of roving to produce a yarn of

the desired size. In the Bradford system of worsted manufacture, here described so briefly, the spinning is usually done on cap or flier frames or occasionally on a ring frame, seldom or never on mules, while the French system invariably uses mules for the spinning of the yarn. From the foregoing it will be seen that woolen and worsted yarns are not, as many suppose, spun from different fibres, but are both made from wool by a

Different System of Manufacture.

It is impossible to obtain the same effect on the finished goods from fabrics woven from the two types of yarns. The woolen system is adapted for certain fabrics and the worsted for others, there being no real comparison between fabrics manufactured from wool and worsted, as each may be the best of its type and yet be totally unlike. From the methods used in producing the yarns it will be readily understood that for fabrics requiring definition of pattern, clearness and distinctness of design and color, the worsted thread offers advantages that are far beyond those to be had from the wool yarn, while for the production of goods, the face and colors of which are to be, as our English friends say, melded together, the wool thread is unsurpassed, and the effect can hardly be approximated in fabrics constructed from combed yarns.

On the other hand, the use of woolen yarns for the production of fine textures in designs that require sharp outlines with clear-cut color figures, will result in much inferior effects than are possible to the user of worsted in such constructions. The original use of colors in woven design is shrouded in antiquity, but that the art of dyeing was well known to the ancients is attested by their many references to colored fabrics used as clothing and for decorative purposes. In the early history of the Jewish people we read that the favorite son of Jacob was sold into bondage by his brethren as a result of their jealousy, his coat of many colors being the mark of the greater regard in which he was held by their father. In more recent times

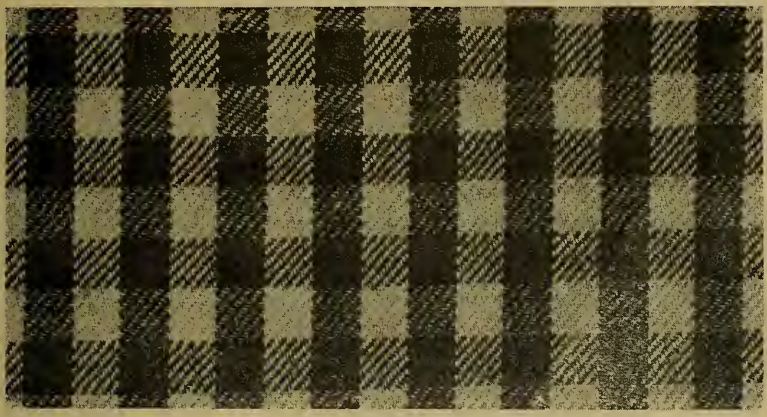
The Love of Color

was exemplified by the figures woven into the blankets and basketry of savage races. Each tribe had its emblem woven into their blankets and baskets or molded into the pottery manufactured by the most primitive of methods. A probable survival of this ancient custom is the distinctive tartans dedicated to the various clans of Scotland. To one familiar with the colors and their arrangement in the plaid it is possible not only to name the clan but oftentimes the particular branch to which the wearer owes allegiance. The shepherd plaid seemed not to be the insignia of a family or clan but to be dedicated to the use of herdsmen of all sections of the country. It is the simplest of all in both color and pattern, being no more than an even check of black and white, a favorite size being four threads of each color in both warp and filling. For men's wear purposes the size may be increased to double that number of threads, while in fabrics for women's wear it is not uncommon to see the size increased

To Nearly an Inch

of each shade. The manufacture of this type of fabric is not especially difficult except in one particular. It must not be undertaken except in a mill that is kept scrupulously clean, as a spot on the surface of the white will show up with startling distinctness. The best effect is obtained by using a bleached white with a black that has a distinctly blue tone. Bleaching may be done in the skein either with peroxide or with sodium bisulphite, the latter method being preferred by many as requiring no special apparatus nor training in its use. The dressing and weaving are done in the ordinary manner, care being taken that every piece of machinery used is free from iron rust, dirt or oil where it may come in contact with the goods. When woven,

the pieces must not be allowed to come in contact with the floor, but be placed on scrays provided for that purpose. As one old Scotch manager



Worsted Shepherd Plaid.

used to say, "Ye'll need tae pit legs under them," and his meaning was not only to have them kept from the floor but to hasten them through the various processes, not allowing them to lie about in any department, lest they become soiled.

During burling and sewing, the operatives must exercise care to keep the goods from the floor, and before placing them in the washer see that it is free from any bits of dirty, oily flocks which may have fallen from goods previously scoured. The scouring may be done with any standard grade of soap, although a tallow soap should not be used, in fact, is never necessary for scouring worsteds, and is not tolerated in many finishing rooms. When thoroughly clean, extract, but not too dry, then put on the dryer and dry at a moderate heat, as too rapid drying has a tendency to give the fabric an inferior handle. Brush, shear and take to the fine sewers, who should find very little work on goods of this character. After an inspection to see that the work of the sewers has been well done, the goods may be brushed, sprayed and pressed, and are then ready for the final examination, preliminary to rolling up for market.

LAYOUT.

4,032 ends; 15½ reed, 4 in dent = 65" + 1½" for listing = 66½" over all.
68 picks.

Dressing:			
2/50 bleached white...	32		32
2/50 black	16	16	32
			64
			*7
			448
			†9
			4,032

*Patterns. †Sections.

CALCULATIONS.

4,032 ends 2/50 = 4.608 oz. + 10% take-up .....= 5.12 oz.

68 picks 2/50 = $\frac{68 \times 66.5}{50 \times 560 \div 16 \div 2}$ = 5.16 oz.

Loom weight ..... 10.28 oz.
Finished weight 9 oz.

COST.

10.28 oz. + 7½% waste = 11.11 oz.
@ 96c. per lb.....= $ .6666
Manufacturing, 68 picks.....= .4000

Net mill cost $1.0666

8 harness, straight draw.

Weave.

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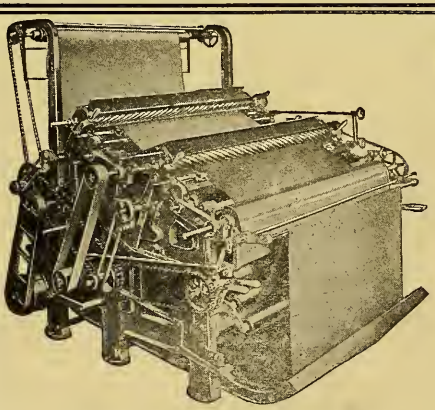

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